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The Physiotherapy Review

Volume 15 Number 3

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Faulty Weight Bearing

With Special Reference to Position of Thigh and Foot

Signe Brunnström

In examining and treating faulty posture, curvature of the spine and weak feet in children for a number of years, the writer has been impressed by the multitude of different foot conditions which can be observed. Anybody attempting to correct faulty body mechanics must take the whole individual into consideration, studying the relationship between the different parts of the body and determining for each case the particular malalignment present. Correction of thighs and feet must be a part of the general posture training and must be emphasized for all cases, regardless of the original trouble which caused the child to be sent to the clinic. The position of feet and legs greatly influences the position of the pelvis, and through the pelvis, acts on spine, shoulders and head. Vice versa, a faulty position of the pelvis may produce incorrect position of the feet. The whole weight bearing problem must be followed up through all parts of the body, if any result is to be expected.

A person with perfect functioning of leg and foot moves the leg, when walking and running, in the sagittal plane. There is no turning out or in of ankle or knee. This is a strong position, permitting springy and effective locomotion, as the muscles work under the best circumstances, mechanically. The weight is transmitted through thigh and leg in a straight line to the foot and evenly distributed to the sole of the foot (Fig. 1). The heel, the head of the first and the head of the fifth metatarsal bones come in closest contact with the ground. If these three points are connected by imaginary lines, we get a triangle, representing the distribution of weight to the sole of the foot. The greatest strain, naturally, is along these lines. Normally, the resistance of bones, ligaments, plantar fascia and muscles maintains the correct relationship between the different parts and keeps up the longitudinal arch of the foot as well as the anterior or metatarsal arch. The lateral part of the longitudinal arch is reinforced by powerful ligaments, the two calcaneo-cuboid or plantar ligaments. These ligaments bind the calcaneus so firmly to the cuboid and the outer metatarsal bones that this part of the foot acts almost as one solid piece.[1] The inner side of the arch is much more flexible. The ligaments connecting the calcaneus with the scaphoid and the scaphoid with the cuneiform bones are small ligaments with comparatively little resistance. For maintenance of this part of the arch we therefore must rely partly on muscular support. The same can be said about the ligaments supporting the metatarsal arch.

In a normal foot, on each step, the arch gives a little, but it resumes its original position as soon as the weight is taken off. This contributes to a springy, elastic and graceful gait. If the correct relationship between pelvis, thigh, leg and foot is disturbed in one way or the other, some parts have to carry more weight than they normally should. The excess strain on such parts will be very likely to damage their structure. Ligaments will give, muscles will be stretched, and bones will slide out of alignment. The surface of contact between the bones will slowly change due to changed pressure. A condition which started as a displacement of weight may finally result in serious permanent structural changes, causing the individual discomfort and pain, and making his gait awkward, clumsy and inefficient.

The importance of discovering wrong weight bearing early, and, if possible, correcting such displacement is evident. In examining children with faulty posture and weak feet a great number of different kinds of malalignment of thigh, leg and foot can be observed.

Figs. 2, 3, 4, and 5 illustrate some common types of wrong weight bearing. There are other types falling in between these, and it is impossible, here as well as in other fields, to make a satisfactory classification which would include all cases.

In Fig. 2 the weight is placed too much on the outer border of the foot, the patella is turned out and the thighs are rotated outward. At first glance one is apt to say that the person is "bow legged." At an early stage, however, he is able to correct the malalignment, if given proper instruction, which indicates that his condition is not a true genu varum. If of longer standing, the correction may not be possible. This kind of malalignment seems to be more common in boys than in girls. The position seldom causes any discomfort, as the outer border of the foot due to its structure can stand a considerable amount of increased pressure. The gait, however, will be unesthetic, the individual will waddle from side to side and he will wear out his heels on the outer side. Often he walks with his legs too far apart, which makes his shift of weight from one foot to the other too noticeable. This condition is rather exceptionally brought to clinical attention, because of the absence of pain and because of the failure on the part of the parents to recognize it as an incorrect posi-

Hospital for Ruptured and Crippled, New York City.

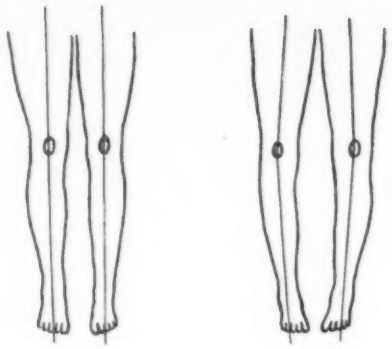

Fig. 1. Correct weight bearing. The weight is transmitted through thigh and leg in a straight line to the foot and evenly distributed to the sole of the foot.

Fig. 2. Thighs outward rotated, weight too much on outer border of feet. The gait is clumsy and the individual waddles from side to side.

tion. In physical education periods in school, particularly in boys' classes, it will be easy to recognize such cases because of their characteristic way of walking.

To overcome such awkward gait, the following exercises are suggested:

Exercise 1. Stand in front of a mirror with the toes pointing straight forward, the feet together and the weight evenly on both feet. Rotate thighs slightly inward, which movement will cause the body weight to be shifted from the outer border to the whole sole of the foot. Press down the big toe and the head of the first metatarsal bone, without, however, everting the foot to any considerable degree. This is accomplished by using flexor hallucis longus and peroneus longus, which latter muscle through its pull on the base of the first metatarsal bone slightly everts the foot causing the head of the first metatarsal bone to come in contact with the ground.

Exercise 2. In the correct position as described above rise on tip-toes, practicing a springy movement up and down. The movement is performed by the calf muscles and controlled by the peronous longus, which muscle by its contraction prevents undue inversion. This heelraising is first practiced with the weight on both feet, then on one foot alone, shifting frequently from one foot to the other. The position of the shoulders is observed in the mirror. When shifting the weight from one foot to the other the shoulders should stay on the same level.

Exercise 3. In the correct position in front of the mirror, raise the fore part of the foot off the ground (dorsal flexion), alternating left and right. Again the position of the shoulders is observed and the trunk is not allowed to move from side to side. If the calf muscles and the heel cords are tight, preventing a normal dorsal flexion, stretching exercises to overcome this condition are given.

Exercise 4. Practice walking forward and backward in front of mirror, controlling position of feet, thighs, and shoulders. No waddling allowed. Imagine that you are walking on a narrow plank; try to pull the weight toward the middle of the body and upward.

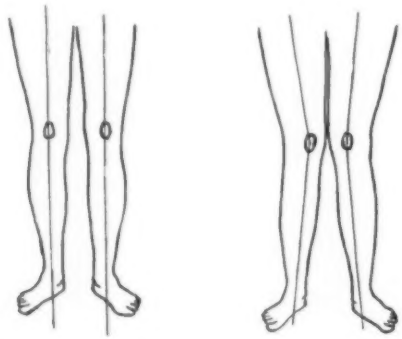

Fig. 3. Feet everted, thighs straight. The weight falls too much on inner side of feet, tending to flatten the arch.

Fig. 4. Feet everted, thighs inward rotated. The weight is borne too much on the inner border of the feet flattening the arch. The position of the thigh favors knock knee position. This malalignment is more common in girls than in boys.

In Figs. 3, 4, and 5 the feet are everted and too much weight falls on the inner side of the foot, causing a constant strain on the arch, which will be lowered or completely flattened. Most of the common foot troubles, called weak arches, pronated ankles or flat feet belong to one of these groups. The typical symptoms are familiar to all of us. The patient walks with his toes turned out and has a clumsy and unelastic gait. He complains about his feet easily getting tired and sore. Sometimes there is a pain in the whole foot, sometimes the pain is localized on the inner side of the foot, where particularly the sustentaculum tali and the calcaneo-scaphoid ligament are sensitive to pressure. The calf muscles are often shortened and the patient may feel the pain in the calf. Usually the metatarsal arch is involved. The ligaments which hold the heads of the metatarsal bones together are overstretched, causing the heads of the second, third, and fourth metatarsal bones to be lowered. As this part of the foot was not intended for weight bearing, the points of contact with the ground become sore. Calluses in this region of the sole, caused by pressure, are common appearances.

Fig. 5. Feet everted, thighs outward rotated. This position is more common in boys than in girls.

In children, however, faulty weight bearing as shown in Figs. 3, 4, and 5 more rarely causes pain. If the condition is discovered early enough and attention is given to its correction, the children can be spared much pain and trouble, which, with great probability, would appear in later years.

In order to determine the most common position of the thigh in children with weak arches, the writer undertook to record all cases coming to her attention since September, 1934. The classification was as follows:

Group I. (Fig. 3). Feet everted, thighs straight. The position of the thigh was considered straight regardless of the presence of genu valgum or genu varum, as long as there was no outward or inward rotation of the thighs.

Group II. (Fig. 4). Feet everted, thighs inward rotated. This condition most frequently is accompanied by knock knee, either real or apparent.

Group III. (Fig. 5). Feet everted, thighs outward rotated. Some cases of this type have knock knee, some bow leg, others have normal knee position.

A total number of 251 children in the ages between five and eighteen were examined. Tables I and II show the distribution among the different groups.

Fig. 6. Hook back lying, dorsal flexion of feet with inversion and toe gripping.

Table I.

	boys	girls	total
Group I	22	47	69
Group II	14	126	140
Group III	20	22	42
	56	195	251

Table II.

	Total number	Group I	Group II	Group III
Boys	56	39%	25%	36%
Girls	195	24%	65%	11%

These tables show that almost four times as many girls as boys were treated for weak arches. Of the boys the largest number had no rotation or outward rotation of the thighs. Only a small number (25%) had inward rotation. Of the girls by far the largest number (65%) had inward rotation of the thighs and the remaining number no rotation or outward rotation. The most common type of wrong weight bearing among boys then would be the one shown in Figs. 3 and 5, whereas the girls more often correspond to the type shown in Fig. 4.

In addition to the four above mentioned types of wrong weight bearing, a fifth type has been observed. This is one in which the thighs are inward rotated and the child is walking pigeon-toed. In spite of the fact that the toes are turning in, the foot is everted and the weight is borne mainly on the inner side of the foot. This position has been observed particularly in children of five years of age and younger. The child seems to walk on the whole sole of the foot, using the foot as one solid piece. Even when running there seems to be no springy movement of the ankle. The calf muscles are little developed and under poor control.

There will be no attempt to give a satisfactory explanation of the reason why in certain cases the thighs have a tendency to rotate outward while in other cases they rotate inward. The prevalence of inward rotation (as well as knock knee) among girls may be accounted for by the more oblique position of the femur in females. The position shown in Fig. 4 is typically female, though, as the tables show, it also occurs in boys.

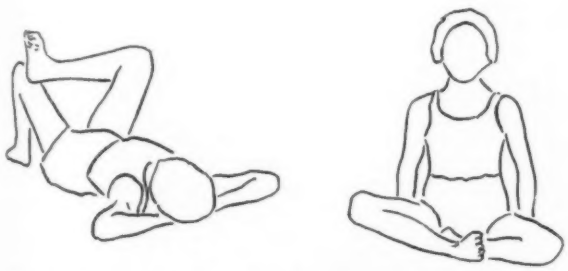

Fig. 7. Hook back lying, alternating knee lifting, "look at the wrinkles in the sole of your foot."

Fig. 8. Cross sitting toe gripping and dorsal flexion.

One conclusion to be drawn from the observations is that it would be foolish to prescribe the same treatment for all cases of weak feet, when the variation of foot and thigh position is so great. Yet one often hears wholesale prescriptions of exercises for weak feet without consideration of individual differences. "Rotate thighs outward rolling body weight over to the outside of the feet," is one advice often given. Naturally, this brings an already outward rotated thigh into extreme outward rotation, and raises not only the arch on the inner side of the foot but also the head of the first metatarsal bone off the ground, a position which certainly can not be considered correct.

It is evident, that each case must be considered individually, and exercises prescribed to suit the particular type of malalignment present. If one knows what a correct relationship between thigh, leg, and foot is, and tries to re-adjust with this in mind, one cannot go very far wrong. The exercises suggested below have, in the writer's own experience, proved valuable for the realignment in wrong weight bearing. Some of them may be better to use for one case and some for another. Obviously, they must be chosen and carried out in the light of the above mentioned observations.

Exercise 5. Sitting posture training for feet. In

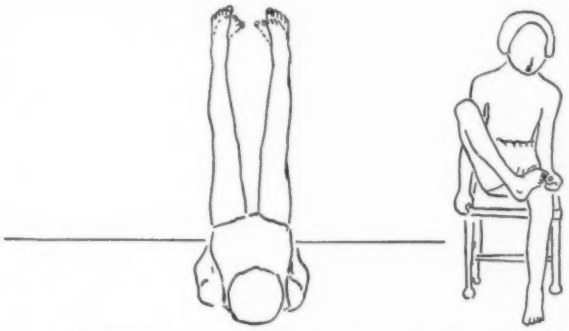

Fig. 9. Back lying, feet up against wall, toe gripping, inversion, dorsal flexion.

Fig. 10. Sitting pick up marbles with toes.

sitting position with right angle at hip and knee joints and with feet parallel, raise inner side of feet, transferring weight somewhat to outer border. Keep the big toe steady on the floor and start the arching at the first metatarso-phalangeal joint. This activates the tibial muscles, the flexor hallucis longus, the flexor digitorum longus, the peroneus longus, and the small muscles of the sole of the foot, the combined action of which maintains the arch. Both tibial muscles aid directly in holding up the arch. The peroneus longus pulls the base of the first metatarsal bone toward the lateral border of the foot, thus acting as a bow-string for the posterior part of the transverse arch. The role played by the flexor hallucis longus and the flexor digitorum longus is usually underestimated. Flexor hallucis longus is a comparatively powerful muscle. Its tendon enters the sole of the foot underneath the sustentaculum tali on the lateral side of the tendon of the flexor digitorum longus. After crossing the tendon of the latter muscle, it runs on the medial border of the sole. Its direction of pull is very favorable for increasing the height of the longitudinal arch. The leverage of the flexor digitorum longus is improved by the crossing of its tendon by the tendon of flexor hallucis longus. At the crossing a portion of the latter's tendon joins the tendon of the former which further stabilizes

the mechanism. The two muscles acting together shorten the distance between the heads of the metatarsal bones and the calcaneum, particularly if the toes are held firmly on the ground and are not allowed to curl. In performing this exercise it must be insisted upon that the toes are held straight and that the head of the first metatarsal bone is kept down. It is not sufficient to put the weight on the outer border of the feet, allowing the whole inner side to rise. The weight of the leg then inverts the foot, and the movement has no therapeutic value. In a case of very flexible weak feet, it would overstretch the peroneus longus, which would only increase the instability of the foot.

Exercise 6. Standing posture training for feet. In correct standing position with feet parallel, take same correction as in previous exercise. If the condition corresponds to Fig. 4, the thighs must be rotated slightly outward and the knees pushed apart. If the thighs are already outward rotated, as in Fig. 5, it will be necessary to inward rotate them until the patella points straight forward. This adjustment is pretty difficult to carry out, as great care must be taken not to lower the arch when the thighs are rotated inward. Contract buttocks and abdominal muscles. This will extend the hip and keep the pelvis in right position.

Exercise 7. Walking posture training for feet. Practice walking, keeping feet, knees, thighs, and pelvis in position described in the previous exercise. Be sure to keep the big toe down on the floor.

Exercise 8. Hook back lying, dorsal flexion of feet with inversion and toe gripping. (Fig. 6.) In hook back lying position with feet separated and parallel, grip with toes, turn feet slightly in and raise forefeet off the floor as high as possible, keeping heels down. Keep position ten seconds and return.

Exercise 9. Hook back lying, alternating knee lifting, "look at the wrinkles in the sole of your foot" (Fig. 7). In hook back lying position raise right knee, rotating thigh outward. Put right heel on left knee. With foot in plantar flexion invert the foot (action of posterior tibialis), then grip with toes and dorsal flex foot (action of anterior tibialis).

Exercise 10. Cross sitting toe gripping and dorsal flexion. (Fig. 8.) In the cross sitting position feet are already inverted. It is a good position, because the patient can watch his feet while performing the exercise. Emphasis is again given to inversion, first in plantar flexion, then in dorsal flexion. Sitting with right leg in front of left, the exercise is taken first for the right foot a number of times; then the legs are shifted, and the same exercise is repeated for the left foot. If the feet are very stiff, the patient can give passive stretching in the following way: With right foot in front of left, put left palm in arch of right foot. With right hand take hold of forefoot and force right foot into inversion and dorsal flexion, bending toes.

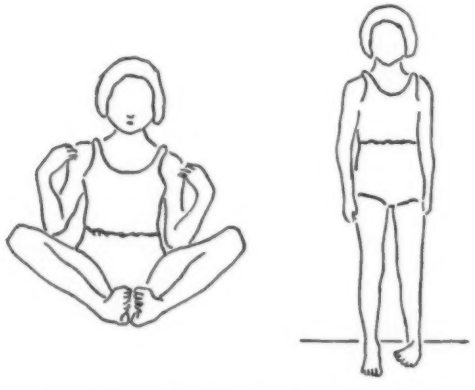

Fig. 11. Hook sitting, "sole against sole."
Fig. 12. Back lean standing, alternating foot raising with inversion and toe gripping.

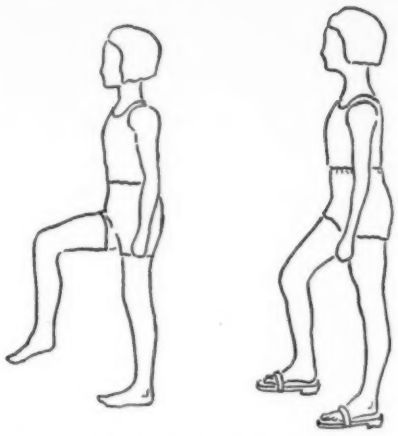

Fig. 13. Half hook standing, keep balance.
Fig. 14. Walking with wooden sandals.

Exercise 10. Lying feet up against wall, toe gripping, inversion, dorsal flexion (Fig. 9). In the starting position feet are kept parallel, heels (but not soles of feet) are touching wall, knees are straight. Grip with toes, turn feet in and pull forefoot down. Keep thighs straight; localize the movement to the feet.

Exercise 11. Back lying, soles of feet against wall, toe gripping, inversion, dorsal flexion. In back lying (or long sitting position), soles of feet against wall, feet separated and parallel, grip with toes, turn feet in and pull forefoot off wall, keeping heels on wall. This exercise is similar to the previous one, but harder, because the ankle joint has to be forced to an acute angle, which puts a strain on the calf muscles.

Exercise 12. Sitting foot circumduction. Sit on stool, one leg crossed over the other. From the relaxed position turn foot in, then pull up, gripping slightly with toes, hold position ten seconds, then relax and allow foot to drop again.

Exercise 13. Sitting pick up marbles with toes (Fig. 10). If using right foot, place marbles in left hand, which is held on left knee. This exercise can also be done in standing position, which makes it a balance exercise.

Exercise 14. Hook sitting, "sole against sole" (Fig. 11). In hook sitting position with knees separated, hold soles of feet together. Raise forefoot off the ground and bring knees somewhat together without separating soles.

Exercise 15. Back lean standing, alternating foot raising with inversion (Fig. 12). Stand back flat against wall, feet parallel and separated a few inches. Raise forefoot off the floor, turning foot in and gripping with toes, alternating left and right. Keep pelvis, back, shoulders, and head in good position. For stout persons this exercise should be done in sitting position.

Exercise 16. Half hook standing, keep balance (Fig. 13). Stand feet parallel, arches high. Raise one knee, putting weight on the other foot. Do not allow the arch to drop. Putting body weight on one foot and maintaining balance activates and strengthens muscles of foot and leg.

Exercise 17. Standing or walking on tilted board. Exercise on the tilted board forces the patient to put the weight on the outside of feet. The inner side of the foot should be kept parallel to the middle line. For variation use different leg, arm, and trunk movements. If a tilted board is not available, a white line on the floor will substitute.

Exercise 18. Walking with wooden sandals (Fig. 14). By each step the foot that is lifted is slightly dorsal flexed; at the same time the toes, especially the big toe, push against the sandal to keep it from slipping, which raises the arch. (Muscle action compare exercise 5.) This exercise has an advantage over most previous exercises: it activates strongly the peroneus longus, which muscle holds the front of the inner side of the foot down. As this muscle is enormously important for

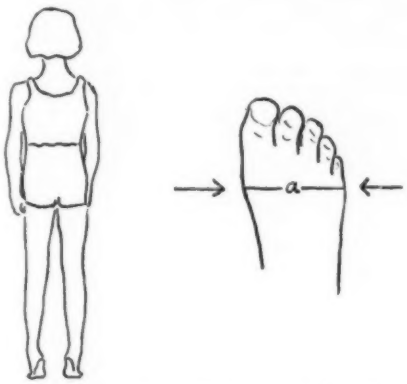

Fig. 15. Standing on tiptoes, feet parallel, inversion of feet.
Fig. 16. To make foot narrow.

the stability of the foot and the maintenance of the arch, this exercise is very valuable.

If the peroneals or the calf muscles are contracted, which is often the case, they need special stretching exercises. If no shortening of the calf muscles is present, exercises on tiptoes, preferably with slight inversion, are valuable. All tiptoe exercises activate the posterior tibialis as well as the peroneus longus, which muscles in this position largely control the side movements of the foot and assist in maintaining the balance.

Exercise 19. Standing on tiptoes, feet parallel, inversion of feet (Fig. 15).

Most of the previous exercises aim at correcting not only the longitudinal arch, but also the transverse or metatarsal arch. Particularly exercises 5, 6, 7, and 18, as well as all toe gripping exercises have a tendency also to raise the metatarsal arch. In this connection it may be wise to recollect that it is just a matter of custom to talk about the longitudinal and the transverse arches as two separate arches. In reality, the longitudinal arch extends into the transverse and what affects one arch will also affect the other. The special exercise suggested below aims at conscious control of the small muscles of the foot which act as bow-strings to prevent the spreading out of the foot sideways.

Exercise 20. To make foot narrow. Sit with soles of feet on floor and toes pointing straight forward. Try to make distance (a), Fig. 16, shorter, that is, the foot narrower, keeping toes straight on floor. At first it is merely a thought and no apparent result will follow. After some practice, however, the kinesthetic sense will improve, and the foot will actually become narrower. If the foot is stiff and does not respond to this exercise, it may be wise to assist the movement in the following way: Place tips of fingers on the lateral and medial border of foot and press the foot together in the direction indicated by the arrows. Hold position a few seconds and then relax. Repeat. This exercise activates the tibial muscles, the peroneus longus, the transverse head of the adductor hallucis and also other small intrinsic muscles of the sole of the foot.

SUMMARY

Observations on 251 cases of weak arches showed that the position of the thighs greatly varied in different cases. In girls the most common malalignment (65%) was inward rotation of the thighs and everted feet (Fig. 4), while boys more often had no rotation, or outward rotation of the thighs (Figs. 3 and 5).

Consideration must be given to this fact when prescribing corrective exercises for weak arches. Each case must be given individual attention. The aim of the exercises must be to restore the correct relationship between pelvis, thighs, legs, and feet. Emphasis should be given to exercises of a type which activates not only the tibial muscles, but also the flexor hallucis longus, the flexor digitorum longus, the peroneus longus, and the intrinsic muscles of the sole of the foot. Exercises 5, 6, 7, 18 (Fig. 14), and 20 (Fig. 16) are considered particularly valuable.

1. See Bowen and McKenzie: Applied Anatomy and Kinesiology, Chapter X.

Scoliosis and Functional Insufficiency

A Non-Operative Treatment of So-Called Adolescent Scoliosis

Emil D. W Hauser, M. D., F. A. C. S.

The ancient Egyptians were familiar with curvatures of the spine. Hippocrates left a description of scoliosis and even suggested a remedy. However, despite its early recognition, scoliosis has remained one of the obscure subjects in orthopedics. Though the deformity is obvious, it has been said that the understanding of scoliosis serves as a criterion of the orthopedists's knowledge. Where the etiology of a disease has not been clearly established, many theories and ideas prevail and tend to confuse; thus in scoliosis the opinions are numerous, diversified, and often antagonistic. It is with a feeling of diffidence that I enter upon an endeavor to establish certain fundamental ideas, which may differ essentially from the usual conceptions. An early interest in the subject led to an opportunity to study scoliosis in this country and in Europe; my views are thus based on the experience of recognized authorities, as well as on my own experience. A logical application of these views, which represent a choice of the opinion of the authorities, led to the adoption of the method of treatment to be described.

At present scoliosis is best defined as a permanent lateral curvature of the spine. This distinguishes it from so-called poor posture, where the deformity is temporary. A curvature of the spine is either primary or secondary. The origin of the primary curves involves the whole question of the etiology of the scoliosis; the secondary curve results as a mechanical compensation for the original curve. The literature on scoliosis is replete with confusing terminology chiefly because the basis for classification is not clearly borne in mind.

On the basis of an anatomical classification, all lateral curves are either simple or compound. The simple C-curve represents the early uncompensated primary curve; after the compensatory curves appear the spine assumes an "S" shape. The direction of the deviation further determines the type. If the convexity points to the right, the scoliosis is classified as dextra; if in the opposite direction, as left or sinistra. Usually the lateral curvature is accompanied by a twist of the spine. The vertebrae twist on their axes and assume an altered relationship to each other. This is termed rotation, and its degree of severity varies. On the basis of anatomy it is thus possible to speak of an "S" scoliosis with a primary left lumbar curve, a secondary right dorsal curve, and a moderate degree of rotation.

In the field of morbid anatomy are the structural changes. Primary structural changes give rise to scoliosis, while secondary structural changes result from the altered statics brought about by the curvature. The congenital malformations of vertebrae represent primary structural changes. The altered position of the back and the new demands made upon the anatomical structures bring about a new form in the tissues. The bony changes can be pictured with the roentgenogram. The accompanying changes in the intervertebral joints, ligaments, and muscles can be visualized in view of postmortem studies of the morbid anatomy of scoliosis. The changes in the bone and in the soft tissues tend to limit the motion of the spine and bring about what is clinically known as a fixation.

Fixation belongs in the field of physiology for it has primarily to do with function. As we shall see later, it limits one of the functions of the back, that of motion, but aids the much more important function of maintaining the erect posture of the body. When the back is capable of carrying out this function it is said to be "sufficient." An "insufficiency" arises when there is a weakness in the structures of the back or when the normal back is overstrained by too great a load. The presence of an insufficiency manifests itself in symptoms of ache and fatigue. The classification based on the physiology of the back, therefore, is important clinically, but the classification to be preferred rests on the etiology.

Classification of Scoliosis

We classify scoliosis on this basis first of all into congenital and acquired. The congenital type may be with or without structural changes. In the first instance a dysplasia exists; for example, one or two vertebrae are absent. In the second type a C-curve is apt to result from a cramped position held over a prolonged period in utero.

The acquired scolioses of proven origin are due to a single cause which is traceable to either general or local disease. A disease, involving the back directly or indirectly, will, in time, result in a permanent spinal curvature. Rickets is a general disease which frequently produces a scoliosis. Likewise osteomalacia, a rare disease, causes a curvature. Another cause of this type of scoliosis is paralysis which may be flaccid or spastic. The most common paralytic scoliosis is a residuum of anterior poliomyelitis. In this connection I wish to emphasize that a paralysis of the abdominal muscles causes a scoliosis of the spine. Spastic hemiplegias presuppose a certain amount of spinal curvature. A scoliosis may also be acquired secondary to a deformity in another part of the body. A short lower limb will be compensated for by a tilt of the pelvis and ultimately a curve in the spine. Whether the limb is actually shorter or only apparently shortened by an adduction deformity at the hip, the scoliosis forms just the same. Torticollis often has a compensatory curve lower in the spine. Local diseases in the spine, as an unequal tuberculous destruction, or a new growth, or a trauma, are sometimes complicated by a lateral curvature of the spine. A contracture of the pleural cavity as a result of empyema also brings about a type of scoliosis. In the same way the protective scoliosis secondary to a painful lesion in the sacroiliac, or a sciatica, might be included.

One more group remains to be classified on an etiological basis—the adolescent scoliosis, also called idiopathic, static, occupational, habitual, postural, and simple scoliosis. The term "idiopathic" should be eliminated as obsolete. The etiology of this type no longer remains unknown. It is true no one cause explains the entire group, but on the other hand certain known etiological factors are always present in this group. The scoliosis arises secondary to an "insufficiency" of the back. A com-

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mon factor that decreases the normal strength of the back is the rapid growth that occurs during the period of adolescence. Debilitating diseases lower the strength of the back, which accounts for post scarlet fever scoliosis. Children physically below par, if not guarded, slowly develop a scoliosis in a similar manner. Failure of sufficient structural development in the back is often traceable to lack of fresh air and sunshine, proper food, and physical exercise. The introverted child with studious, indoor tendencies and poor muscular coordination is very prone to lateral curvatures of the spine. An increase of the load, if unilateral (for example, carrying heavy books in one arm), is readily conceived as a possible cause of scoliosis. The unilateral load, however, plays a very minor role as a cause of simple scoliosis. The primary function of the back, as has been mentioned, is to hold the erect position of the body. If this function is unduly prolonged a strain will result. The exertion required to hold an erect position has been experienced by all who have stood at attention for a long time. To sit at attention is not much easier. Yet the growing child in school not infrequently is made to hold the erect position for hours at a time. It is no wonder that public school statistics show such a high percentage of lateral curvatures. The normal load may be not only prolonged but also actually increased. Excessive body weight increases the load, it is true, but more important are the extraneous burdens. The adolescent girl who constantly carries a child about, or the growing youth who learns a trade, are subject to scoliosis. There are thus many circumstances that increase the load or decrease the strength of the back, and all may act as factors in the etiology of simple scoliosis. Usually a combination of factors is required, and each factor assumes a different degree of importance in the individual case. A careful history and physical examination as a rule reveal the etiological factors of the so-called adolescent scoliosis.

The treatment of scoliosis of known origin consists primarily in the removal of the cause, or, where this is impossible, improvement or correction of the effect. Where further special orthopedic measures are necessary, these will coincide with the principles that apply to the treatment of adolescent scoliosis. It will be possible, therefore, to confine the further discussion of scoliosis to the so-called adolescent type.

Adolescent Scoliosis

The adolescent scoliosis in its incipient stage is a simple C-curve. Unfortunately it is not frequently seen in this early stage. The right dorsal and left lumbar curves compose about 80% of the cases; the other 20% show inverted curves, left dorsal and right lumbar. Likewise the question of which is the primary curve has not been established. A review of the literature dealing with this problem, and the study of typical cases have led me to favor the lumbar curve as primary.

The curvature usually grows progressively worse if left untreated. Rotation appears by the time a compensatory curve exists. In the dorsal area the ribs emphasize the rotation of the vertebrae, and the chest deformity is marked, while in the lumbar region the transverse processes are comparatively short and the rotation, though equally great, is not apparent. The roentgenograms reveal lumbar rotations with the transverse processes in the oblique position. In the usual form of scoliosis the left shoulder droops lower than the right; the right posterior chest bulges while anteriorly it is depressed; the right scapula is more prominent than the left; and the left chest wall is compressed posteriorly with ribs curved downward. The vital capacity is diminished. Often the shoulders droop forward and the normal lumbar curve is accentuated while the abdomen tends to be pendulous. Muscle tone is impaired; the pelvis tilts to the right, and the left hip seems prominent. Fatigue and backache, the symptoms of insufficiency, are frequently present. In very severe cases pain may occur, due to nerve impingement. The insufficiency is measurable by the amount of voluntary correction possible. The child stands in his usual position and then makes himself as tall as possible. There is then a direct proportion between the increase in height and the amount of insufficiency in the muscles of the back. In many cases a deformity exists without insufficiency. In these cases the insufficiency has been compensated for by a curvature and fixation.

Many of the etiological factors are preventable. Early recognition of the presence of a beginning curve will greatly decrease the frequency of abolescent scoliosis. The responsibility falls largely on the school nurse and the gymnasium instructors as well as on the physician. They should all be familiar with the predisposing factors and able to recognize them, and experience will soon familiarize them with an insufficiency of the muscles of the back. During the examination of a child, sufficient exposure of the body should be obtained to permit a view of the gluteal cleft as well as of the back. An oblique course of the gluteal cleft helps identify a pelvic tilt. Granted, then, a knowledge of possible factors, a thorough physical examination and the case history, the diagnosis of adolescent scoliosis becomes a simple matter.

Once the predisposing factors are discovered, treatment is directed against them. The strained back is given rest, and overexertion is guarded against. The child remains under supervision until normal strength is regained. The child with a food deficiency is placed on a high caloric, high vitamin, and, if indicated, antianaemic diet. The shut-in child with sedentary habits is encouraged (or induced by means of games and companionship) to exercise in the open air and sunshine. In addition, a course of regular setting-up exercises is prescribed.

Once a deformity has developed, treatment has a two-fold objective; first to correct the deformity, and second to remove the disability. Solicitous parents readily understand the significance of the deformity, but the disability resultant on an insufficiency needs emphasis. To the child who will be dependent on a back of normal strength for his livelihood, function is paramount, but some people attach more importance to appearance. Fortunately, the appearance always improves with the removal of the functional insufficiency.

Many methods have been tried to correct the deformity, but most of them fall short of a complete anatomical correction in well developed cases. Extension of the spine with the patient in bed is a method often used. Traction weights are applied to the head and feet, or to the feet only, with the foot of the bed elevated to give counter traction. Hyperextension of the back is also obtained by putting the patient on a convex frame. A plaster of Paris bed with a corrected position has been used. The principle of gradual over-correction by wedging has been tried along with the plaster bed. Rest in the over-corrected position gradually straightens the deformity. Prolonged rest causes an increased muscular weakness, so whatever correction has been obtained must be held by means of a support. Plaster of Paris, as a moulded jacket, is the support most frequently used, but leather and steel, as well as cloth corset with stays are sometimes indicated.

Plaster of Paris is used also as a corrective measure

when the patient is up and about. On an upright, or horizontal, frame the patient is first extended; then pressure is exerted over the convexity. Correction and pressure are then maintained with a plaster of Paris jacket. Some of these jackets are made to include the head and shoulders as well as the trunk and pelvis; others to include a thigh. Attempts have been made to derotate the spine by a twist in the opposite direction with direct pressure on the ribs, and, more recently, by turning the pelvis with the trunk fixed. Another technique that received wide acceptance for a time was based on the fact that mobility of the spine is increased in the flexed position. The method depended on direct pressure for correction and proved much too heroic. Windows cut in the cast over the concavity permit the chest in that area to expand with each inhalation, and in this way the respiratory forces tend to correct the deformity. An increase of pressure over the convexity by the gradual addition of felt pads needs no further explanation. However, direct pressure brings with it pain, discomfort, and the danger of pressure sores.

Even before mechanical measures were scientifically applied, exercises were in vogue as a means of correcting a scoliosis deformity. Based on the idea of functional insufficiency and the etiology given above, any exercise that increases strength is potentially a corrective exercise. The early idea of corrective exercises was founded on the conception that the scoliosis was due purely to a muscular disbalance. The object was to strengthen only one side of the back. Though based on a misconception, those exercises frequently brought about a noticeable improvement.

Exercises for a back already strained only increase the symptoms. Rest or support must precede the exercise. Periodic rests of a half hour in the horizontal position at intervals of three to four hours are effective measures. Plaster of Paris jackets and corsets are invaluable for giving rest to the strained back. Graduated exercises will then slowly permit a development of the muscles until sufficient strength has been gained to dispense with the support.

In the absence of a fixation, the retention of correction is essential after the deformity has been corrected. Such retention over a long period of time will bring about a fixation. Recently operative measures have been introduced which will hasten a fixation.

An operative fusion in itself cannot bring about a complete cure. The operation does not bring about correction of the deformity. The maximum amount of correction must precede the fusion, but the fusion can retain the correction secured. In adolescent scoliosis a fusion operation is rarely, if ever, necessary.

TREATMENT

From a general discussion of scoliosis problems we are now ready to turn to the application of the ideas developed. The history of the scoliotic child is taken especially to ascertain the causative factors of the scoliosis. The physical examination must include the weight and height of the child, and tests for anaemia and cardiac sufficiency. To secure the full cooperation of the parents and the child, the condition of the back, the treatment proposed, and the danger of discontinuing treatment once started are clearly explained.

After cooperation is assured the child is ready for a cast. Nearly all cases go home the same day the cast is applied. In applying the cast a simple upright frame is used. An additional board is fastened just below the level of the patient's groin. The patient stands against the board. Sufficient raise is put under the foot of the shortened limb to level the pelvis. A muslin bandage about two inches in width is wrapped around the patient and the cross-bar and the pelvis are more or less fixed. With a right dorsal scoliosis the bandage also includes the right side of the frame while the inverted type of scoliosis is fastened to the left side of the frame. A Sayre type of overhead extension is then fitted beneath the occiput and underneath the chin. The extension is drawn forward, and in case of a right dorsal curve, well over to the left. Then by means of ropes and a pulley the body is extended, drawn forward and to the left. The right hand grips the frame high and forward, the left holds posterior to the mid-plane and below the level of the shoulder.

The body is snugly covered with stockinette, and a layer of sheet wadding is smoothly fitted over the stockinette. Pads of felt protect the iliac crests, the sacrum, and the ribs over the convexity. A six-inch width of plaster of Paris is carefully but quickly wrapped and moulded onto the body. The orthopedist sits behind the patient and the assistant in front. One nurse wrings plaster while a second nurse stands by to adjust the extension and rub plaster.

As soon as the plaster sets the patient is released. The cast is trimmed so that the arms can move freely and the patient can sit comfortably. No more than is necessary is trimmed from the lower margin. Several hours later, a window is cut in the cast over the epigastrium to permit free respiration and allow for a full stomach. The child is allowed a day or two to get accustomed to the cast and then the exercises are started.

Now, the levelled pelvis is a fixed point. About 75% of the motion of the back is in the region of the lumbar spine. The mobility in the lumbar area permits the child to lean to the side. After the cast has been applied the child tries to stand erect and exerts a force against the fixed dorsal curve. In this way normal standing and sitting tend to correct the lateral curvature. When the patient leans forward the same corrective forces can be brought against the kyphosis. With the arms as levers and the pelvis fixed, derotation is brought about by twisting the trunk in the opposite direction. The direct extension increases the length of the back and tends to correct the curve.

The exercises are definite and the children are taught to carry them out accurately. Correct posture is the first lesson. Extended to his full height the child balances a sand bag on his head. The sand bag is six inches square and has a depth of two inches and weighs about seven pounds. A series of simple exercises are set and the child retains the new posture throughout each exercise. The arms are fully extended and brought up overhead. And the child with the arms extended overhead, the instructor holding the cast, leans back and to the right side and further corrects the deformity. With full extension again the child leans forward, swings to the right, rotates, and then reverses the movements to return to the original position. The body is held erect as first the left and then the right lower limb is raised forward to the side and to the rear. Lying flat on his back the child raises both lower limbs with the knees fully extended. The arms are folded over the chest and the child sits up. Effort is encouraged, exactness demanded, muscle coordination and rhythm are taught. More exercises are added as the child grows stronger. The sand bag is made firmer and heavier and dumbbells are advised. The child takes part in regular gymnasium exercises at the school and plays games with the other children. Once a week he reports for observation. The exercises are further supervised, through cooperation of

the gymnasium instructors, nurses, physical therapists and the parents.

At intervals of three to six weeks the casts are changed. More correction is gained each time. When sufficient correction has been obtained, a form fitting corset serves as a removable support. The corset is gradually discarded and is left off entirely when complete muscular sufficiency has been reestablished. As long as the exercises are continued, muscular strength will guard against a recurrence of symptoms and of the deformity.

Case Studies

The results in a study of forty cases of adolescent scoliosis treated with my method since June, 1927, surpassed expectation. In this series of adolescent scoliosis, twenty-nine of the patients were females and eleven males or a ratio of three to one. The age of the patients at the time treatment was started ranged from ten years up to seventeen years. Four cases under treatment during this period and not included in this series were over twenty-one years of age. These patients were treated for symptoms of insufficiency. The object of treatment in these cases was a firm fixation, after which relief of the symptoms followed. The time of onset is ascertained only with difficulty, since the onset is so very insidious. From the history given by the child and the parents the period of onset in seventy-five per cent of the cases was between ten years and fourteen years of age.

The most consistent etiological factor elicited was rapid growth. The parents in nearly every instance commented on the growth of the child. They grew tall with long extremities. Eighty per cent of the children were underweight and below par physically. Of these again the majority were of sedentary tendency, and eight were definitely introspective individuals. Pneumonia, scarlet fever, prolonged bronchitis repeatedly preceded the onset of the symptoms in the back.

Of these forty cases only two were of the inverted type, that is, with left lumbar and right dorsal curves. Three were simple curves, with the convexity to the right in each instance. It is noteworthy that in these three cases all presented themselves soon after the first symptom was noticed. The proportion of normal right dorsal and left lumbar scoliosis to the inverted type was much greater than is usually given in the statistics. The series is not large enough, however, to attach much importance to this fact. One case had no insufficiency whatever, fourteen were graded with an insufficiency of one on a basis of one to four; twenty classed as two, and four were grouped as three. None of the adolescent scoliotics in this series had a total insufficiency.

The treatment consisted in the use of exercises, casts, and leather and steel corsets on the principle described above. Each patient was regarded as an individual type. The general strength, the morale, the home conditions were all taken into consideration, as well as the type of scoliosis and the question of insufficiency. In two cases a mitral lesion made the treatment proceed slowly and with great care. The school nurse and visiting nurses cooperated in the care of children at the clinics. Once they grasped the principle of the treatment the nurses became interested and as they observed improvement, gradually became enthusiastic and a great aid.

It is indeed difficult to set a standard by which the results can be measured. The chief reason for this is that there are many factors involved. The correction of the deformity or anatomical improvement was first graded by the nurse in charge of the case and then all cases were personally tabulated and rechecked. The results in correction of the actual deformity showed no improvement in two cases, fair improvement in nineteen cases, seventeen cases were classed as good, and two as excellent.

With regard to the impaired function, the insufficiency was relieved in three cases, improved so that normal function could be resumed without symptoms in sixteen cases, and absolutely cured in twenty-one cases. All learned to coordinate their muslces better, and in some this change was striking. With an increased capacity of the back came improved general strength and as a rule steady increase in weight. The children became more active. The sedentary and introvert type of child invariably became more alert and gained poise with self-assurance. The parents as well as the children were pleased with the results. In every case, however, the prognosis had been discussed and as far as possible cooperation was assured before the treatment was started.

No complications of any significance arose as the results of the treatment. There was not a single instance of a pressure sore to delay the course of treatment. The children were not handicapped but in most instances felt some relief and an increase in functional capacity soon after the first cast was applied. They continued at school, took part in regular gymnasium exercises and played with the other children.

To summarize, we obtain good results in a very simple manner. The deformity is corrected and the symptoms relieved. The general physical health is improved and mental hygiene established. There is no pain. The patients do not lose time from their occupations or studies. There is no hospitalization. The cost is very low. There is no risk and the method is remarkably free of complications.

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Causes and Differential Diagnosis of Backache

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If I were asked what is the commonest complaint of the human body, I would answer—backache. And if I were further asked what is the most common cause of backache, and which segment of the spine is most commonly affected, I would say strain of the lumbosacral region.

Long before I studied medicine, and while still a student in college, I recollect reference being made to "railroad spine." I often wondered what was meant by it. In those days, long before our States had adopted the Compensation laws, and while industry was in its infancy, an injured employee had to sue his employer to recover damages. Complaint of backache was so common among the injured employees, that it proved to be a boomerang, and the name "railroad spine" was adopted to describe backache in malingerers. The term is still used at the present time.

The subject of backache has really become a very serious problem, because of the frequency with which it is found in industrial and street accidents. The life of this nation is practically wholly dependent on industry. The automobile has produced more cripples and more fatalities than the world war. It is often stated that if pneumonia does not kill you, the automobile will.

The interpretation of backache has been wrongly delegated to orthopedic surgeons. It actually belongs to the internist or diagnostitian. Dr. L. F. Barker, that eminent clinician, has written a book entitled "Backache." I would advise you to read that book. You will appreciate much better, the problems that are involved in the diagnosis of backache. The greatest advances in this field, however, have been made by orthopedic surgeons.

In order to make a satisfactory diagnosis of backache, the physician must possess a very substantial knowledge of specialties such as neurology, genito-urinary diseases, gynecology and proctology; also he should be familiar with the clinical manifestations of syphilis, focal infections and endocrine disturbances.

The discussion of backache may be approached from different angles. The best approach is the one which is most logical and easiest to remember. We may, for instance, designate two large groups: (1) Backache caused by the involvement of the osseous and ligamentous structures. (2) Backaches referred from other parts of the body or organs.

In the first group are included (a) the different types of arthritis, (b) the endocrine disturbances, (c) the malignant tumors, (d) the postural defects, (e) the congenital deformities, (f) the traumatic conditions.

In the second group are included backaches due to disease of adjacent organs such as the kidneys, gallbladder, the male and female pelvic organs and the rectum.

First, I shall consider briefly, group (2) or backaches due to referred pain. The most common lesion of the kidney causing backache, is hydronephrosis or dilatation of the kidney pelvis. This backache is characterized by being intermittent and acute. It is usually unilateral.

In tumors of the pelvis, chronic inflammatory diseases of the pelvic organs and retroversion of the uterus, the pain is referred to the sacrum and lumbosacral region. The characteristic features of backache referred from the pelvis are as follows: There is no limitation of motion, no points of tenderness, no pain on motion, but the pain is increased during the menstrual period.

In diseases of the rectum, such as hemorrhoids, strictures and prostitis, the pain is referred to the coccyx and sacroiliac joints. Every patient with painful coccyx should be carefully examined by the proctologist. These are, I believe, the conditions most commonly found in producing referred pains to the back.

In greater detail, I wish to discuss group (1), or backaches caused by the involvement of the osseous and ligamentous structures.

(a) Arthritis—There are two large types of arthritis which must be kept in mind, namely, the nonspecific and the specific. The nonspecific includes the toxic or rheumatoid arthritis and the specific type is caused by tuberculosis, typhoid, pneumonia and gonorrhea.

In the nonspecific type, usually there are large areas of the spine involved, and marked tenderness is elicited on pressure of the spinous processes, and of the muscles. The motions are limited and attended with pain. The presence or absence of muscle spasm depends on the acuteness of the condition. One of the most common causes of toxic backaches is chronic constipation. Other sources of infection are the tonsils, sinuses, teeth and abdominal viscera.

In contrast to nonspecific arthritis, the specific type selects one or two vertebrae, the pain is worse on jarring the spine, there is limitation of motion, but usually there is no tenderness on pressure of the spinous processes or the muscles. All of the specific types mentioned, are destructive, that is, there is marked destruction of the cartilage and bone. As a result, the knuckle deformity appears early, and pressure nerve root pains are common. For example, a destructive arthritis of the dorsal spine, will produce so-called intercostal neuralgia, and when the low lumbar vertebrae are affected, sciatic pains may be present.

There are other types of arthritis which do not belong to either of the above types. One of these is the hypertrophic arthritis, which usually appears after the age of forty, or may be the result of hard labor. This type of arthritis does not give rise to pain unless two factors are superimposed—injury or infection. On the other hand, it does give rise to marked stiffness of the affected joint.

Another type is the so-called osteoarthritis "pokerback" (Marie-Strumpell disease). There is very little known about the etiology of this condition. It affects young adults, it is slow in its onset, but it is progressive. It involves first the sacroiliac joint, and secondly the remainder of the spine. The hips and shoulders may also be involved. Perhaps one of the most important diagnostic features of this disease is the limitation of chest expansion due to the calcification of the costal cartilage.

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This usually appears early in the disease. The pain is not very severe, but the unsightly forward bending of the body is quite characteristic.

(b) Endocrine disturbances—Changes in the bones, caused by disturbances of the parathyroid glands, may be localized to the vertebrae, and may be a source of backache. Hyperfunction of this gland produces a decalcification of the bone. Usually the long bones are affected, but not infrequently it selects the vertebrae of young adults. The backaches are not characteristic. The diagnosis is made only from studies of the calcium metabolism and from the appearances of the bone in x-ray.

(c) Malignant tumors—Primary cancer of the spine is rare, but metastasis of cancer to the spine is quite common. There are certain cancers that metastasize to bone, namely, cancer of the thyroid, the breast, the hypernephroma, cancer of the prostate, the stomach and the pleura. The presence of metastases should always be suspected in old individuals with backache. The most significant clinical feature of cancer metastasis to the spine, is the fact that there is nothing which will relieve the pain, except narcotics. Immobilization of the spine, which is so effective in relieving the pain of arthritis, fails to relieve the pain, due to metastases to the spine.

(d) Postural defects—I have never been impressed by the severity or the type of pain in patients with postural deformities, such as round shoulders and scoliosis. In fact, I have always wondered why pain is not more commonly associated with this condition. We see the most extreme cases of deformity of the spine, without pain. Let us not forget, however, that these are weak backs and more liable to strain than a normal back. Most of the patients complain of a tired feeling in the back after prolonged exercise. I have always felt that backaches in an individual with postural deformity of the spine, is the result of a chronic strain or infection.

(e) Congenital deformities—There are certain congenital deformities of the spine, which, in my opinion, do not produce backache. They may be liable to strain. I am speaking of sacrolization of the transverse process of the fifth lumbar, spondylolisthesis, spina bifida and deformities of the posterior articulations. The results of an injury in the presence of these deformities is to produce localizing symptoms in these areas. It is a well known fact, for example, that a strain of the back in the presence of a sacrolization of the transverse process of the fifth lumbar produces a strain of the sacroiliac joint on the opposite side. Likewise, in the presence of spondylolisthesis, a strain will produce symptoms referable to injury to the nerve roots forming the sciatic nerve.

(f) Traumatic conditions—I have saved purposely, the discussion of backache due to trauma, for the last. I feel that industrial medicine has revolutionized our conception of backache, and it has created a state of confusion in the minds of most of us. Our methods of examination of backs have been greatly improved, in order to guard against possible mistakes in diagnosis.

In order to arrive at a satisfactory diagnosis of the so-called "traumatic backs," I have found that the following three things are essential: (1) A careful examination of the patient. The examination should not be limited to the back, but it should include the whole body. (2) The patient should be kept under observation for a long period of time. In this manner one can tell if the signs and symptoms are constant. (3) Localization and distribution of pain.

There seems to be little difficulty in the diagnosis of backache in the cervical, dorsal and upper lumbar segments. Our troubles in diagnosis begin when the complaints are referred to the lumbosacral and sacroiliac joints. The anatomical structure and anatomical relationship of these joints is quite complicated, and this is perhaps the main reason why the diagnosis is difficult. An accurate understanding of the anatomy and surface landmarks is therefore essential.

The lumbosacral joint is the joint between the fifth lumbar vertebra and the sacrum. It consists of three distinct joints, namely, one between the bodies of the vertebrae and two articulations between the posterior processes. Two strong ligaments extend from the transverse process of the fifth lumbar—first, the iliolumbar ligament which is attached to the ilium, and second, the lumbosacral ligament, which is attached to the sacrum. The joint allows flexion, extension, lateral motion and, differing from the remainder lumbar vertebrae, it allows some rotation. The fifth lumbar forms a rather constant angle with the sacrum. The last lumbar foramen is smaller than the rest and yet the nerve trunk may be larger than the others of the lumbar plexus.

The lumbosacral joint is on the same plane with a line drawn between the posterior superior spine of the ilia. On thin individuals, these spines may be easily palpated, and on obese persons a dimple appears over each spine. A line drawn between the posterior superior spine of the ilium and the sacrococcygeal joint completes an equilateral triangle. These last two lines correspond roughly to the surface projection of the sacroiliac joints. Another surface landmark is the so-called Michaeliss rhomboid. According to Williams' description, "a point two and one-half centimeters above the middle of this line" (joining the posterior superior spines) corresponds to the superior apex of this rhomboid. The other apices coincide with the two posterior superior spines of the ilia, and the sacrococcygeal joint. The superior apex fits in a depression just below the tip of the spinous process of the fifth lumbar.

The sacroiliac joints have all the attributes of a true joint, but they allow very little motion. They are adequately supported posteriorly by strong ligaments but not anteriorly. The pyriformis muscle lies anterior to the joint and some of the fibres forming the sciatic nerve lie between the muscle and the anterior surface of the joint (Freiberg). The characteristic radiation of pain into the posterior lateral aspect of the thigh in sacroiliac lesions has been explained on this anatomical relationship between the joint, nerve and muscle. Smith-Peterson believes, however, that the distribution of the pain is referred from the joint itself. The nerve supply of the joint arises from the first and second sacral nerves and the distribution of the pain in the leg corresponds to these two nerves.

Oftentimes there may be some difficulty in differentiating between a sacroiliac and lumbosacral lesion. The differential point depends on the fact that a strain is produced on the sacroiliac joint when the hamstring muscles are placed on tension. In the so-called "leg leverage" or "leg-raising" test, these muscles are stretched. Pain referred to the region of the sacroiliac joint when this test is performed, will indicate pathology in that joint.

Physical Therapy at Perkins Institute

Thelma Pierce

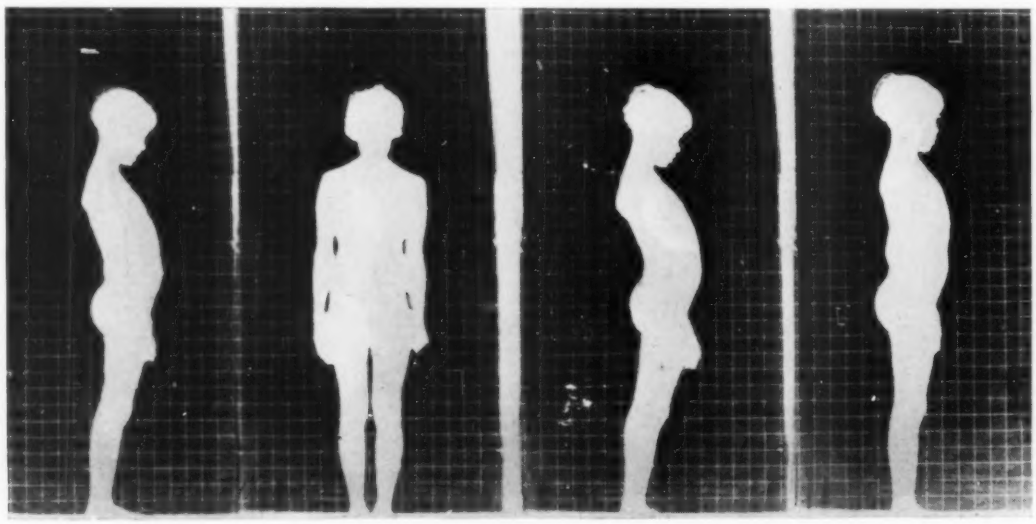
On the banks of the Charles River in Watertown, Massachusetts, appears a tower, impressive and strong, standing sentinel over a group of attractive buildings of late Gothic design. The surrounding recreation fields are dotted with children swinging, jumping rope, walking on stilts, roller skating; girls playing leap frog, boys practicing sprints, standing high and broad jumps, and rowing on the pond. Occasionally a nature study group is heard elating over a new find. Coming nearer, scales and arpeggios are heard from organs, pianos, trumpets and violins, vying with the clicking of braillewriters and typewriters. Entering the buildings, one finds classroom groups studying, rugs being woven, chairs caned, machines being repaired.

This, Activity—Industry—Learning—is P. I., Perkins Institution for the Blind, the home and school of approximately two hundred and seventy-five children for nine months of the year. The purpose of all this intensive and extensive program of progressive education is to enable these children to overcome their handicap and become useful, self-supporting citizens. When we hear some of the graduate students of the Boston Conservatory of Music play, and realize that if blindness had not given them this opportunity to study they might have become obscure factory workers or farmers, we wonder if their loss of physical sight is such a handicap after all. Alfred Adler, psychologist, maintains that nearly all civilization is the outcome of efforts to overcome feelings of inferiority, often caused by a physical defect.

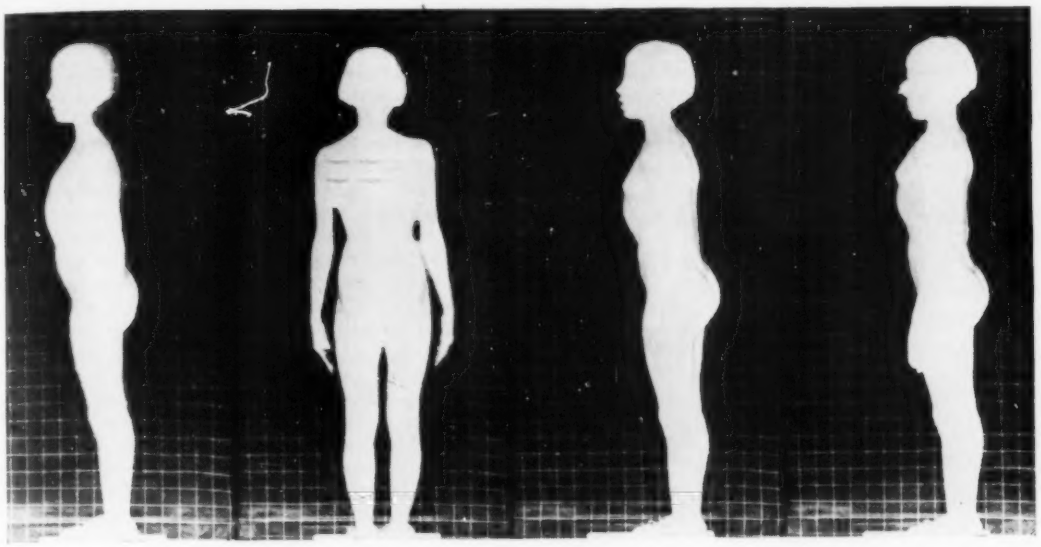
The Institution, aiming to eliminate if possible any other handicap a pupil might have, has established a corrective speech department and a physical therapy department. Posture work as we know, if started early enough, is one of the most important branches of preventive medicine. Without the correct body position insuring the right anatomical position of organs and thus proper functioning, any other preventive measures will be futile. It really should step in on the ground floor. A special department in corrective gymnastics has been in existence at Perkins since 1894.

Early educators of blind people realized that loss of sight is conducive to poor posture. There is no aesthetic appeal and often times the head drops forward simply because there is no reason to keep it up, or because the eyes may be very sensitive to light. In a case of peripheral vision, the head may be held at any unusual angle from a sideward tilt to a tipping backward in order to focus the small amount of sight on an object. In a few cases it has been thought that protruding abdomens were used as "buffers." A blind person is under a physical strain and is apt not to be as active as a seeing person. Taking this into consideration, exercises for this group should be strenuous, recreational, and followed by some form of relaxation.

The physical therapy unit at Perkins occupies one wing of the hospital building; the rest of the building is used by the nurse, dentist, and ophthalmologist. There is the usual equipment of rings, head-slings, tables, a Lovett board which was made by the school carpenter and which swings up against the wall when not in use. There are infra-red bakers as well as the ordinary bakers, blow bottles made by the chemistry department and an ordinary bath tub, used for under water treatments. Accurate records are kept of the diagnoses made by Dr. Frank B. Ober, Chief of Orthopedic Service of the Boston Children's Hospital, who visits the school twice a year. Silhouettographs are taken by Mr. Norman C. Fradd of Harvard each year and these make a very interesting record and also serve as an incentive to good posture. The results for the last two years are as follows (in percentages):



1933
1. Natural position
2. Position assumed when standing at ease
3. Position after corrections had been made



1934
1. Natural position
2. Position assumed when standing at ease
3. Position after corrections had been made

Habitual Posture			*Corrected Posture*		
Class	1933	1934	Class	1933	1934
"A"	3.3%	4%	"A"	5.7%	7%
"B"	8.6	21	"B"	16.4	34
"C"	42.2	47	"C"	50.8	47
"D"	45.5	28	"D"	27.	12

In addition to the regular work of this department, supervision is given to the seating in the dining-rooms and class-rooms. Both boys' and girls' kindergarten houses are equipped throughout with chairs specially constructed to encourage good sitting posture, some being Goldthwaite chairs. About eighty of the pupils have shoe corrections including Thomas heels, Thomas lifts, special lifts, plates and pads.

An effort has been made to make posture tangible and interesting to the pupils through different devices. Plasticine models which were made from actual cases, one with an A posture and one with a D posture have been of particular value. These are not difficult to make. An armature is used placed on a base of plasticine or soft rubber, then the model is worked around this. It should be shellaced to make it more durable. Such models should be of value to seeing children and might even be made by them. Cardboard manikins mean very little to a blind child because of the lack of the third dimension.

Another means of promoting good posture is the Merry Sit-up Club made up of primary girls who have put forth a definite effort to stand and sit well. The activities of this club include hikes, out-door suppers and swimming parties. Caps and slippers have been knitted by them for the Boston Children's Hospital. A very successful posture week was held. Here all started "at scratch" wearing white ribbons which were to be kept as long as good posture was maintained. At the end of the week the white ribbons were counted and the class possessing the most was given recognition. A posture tea and demonstration was held for the faculty, and a posture play was given in morning assembly. As another variation, exercises and sunbaths are given on the roof and the swimming-pool is utilized for some cases to which this form of treatment seems advisable. Good posture in the class-room is encouraged by hanging a good posture banner in the room having the best posture during the month.

Of the forty odd cases treated a day most require only posture training. Traumatic cases are referred for treatment by the medical department. The source of the condition dealt with, and the blindness are sometimes the same as from Still's disease, Raynaud's disease, brain tumor and birth injuries. One case of Still's disease, a girl of about nineteen, has knees, elbows and spine ankylosed. She is just able to reach her feet to put on her shoes, the action taking place in the hip joint. She became blind at six years and now sees shadows with one eye and has light perception in the other. Her treatment consists of baking to knees, elbows and spine with the infra-red lamp, massage, gentle stretching to the elbows, exercises with resistance and as much muscle setting as possible.

The case of Raynaud's disease is a girl of sixteen. At the age of ten she was attacked by this rare, usually fatal disease. She was placed under Dr. Blackfan's care at the Boston Children's Hospital. A condition of multiple gangrene of her extremities developed with a loss of the tips of several fingers. She was transferred to the Peter Bent Brigham Hospital where Dr. Harvey Cushing took the case, caring for these ulcerative areas and performing a lumbar sympathectomy followed a little later by a division of the sympathetic nerves to the right upper extremity. Dr. Cushing had not the slightest expectation that this child would live. Recovery was very slow, but the girl now moves about freely with only a slight limp and reads and writes with ease in spite of her crippled hands. Last year she learned to swim, and won the diving contest in the annual swimming meet. This case is a triumph for her doctors and nurses and for the child's own indomitable will.

Another interesting child is a boy of seven who is a member of the blind-deaf department. There are six children in this department ranging in age from six to nineteen. All but one were victims of spinal meningitis. Three of these children could not articulate at all upon arrival at Perkins. This little boy after about two years of instruction now has a vocabulary of about seven hundred words.

These children are taught to speak by the Tadoma method revised for the blind. At first the child's hands are placed on the side of the face and even inside of the mouth. In this way all the elements of speech are taught

before they are shaped into words. As the child grows older, he places one hand on the face at his own pleasure. When conversing with one of these children, it seems as though wireless messages are being transmitted. This method is far superior to the manual alphabet which was spelled into the palm because by this method anyone can speak with these highly intelligent children.

The Phipps Unit, a method of bone conduction of sound, carried preferably through the teeth, is of untold value in teaching rhythm work. It is also an aid to the intonation and modulation of the voice. The oldest boy plays the piano and has heard his music by having the microphone placed on the piano and the Unit pressed on his mastoid bone. The first case mentioned has work in the physical therapy department for general posture, foot exercises and training in walking. It is difficult for these children because of their double handicap to balance properly. For more information about these pupils see the article on "Hearing through the Ears" in the Cosmopolitan Magazine for March, 1935.

An article on physical therapeutic work at Perkins would not be complete without giving recognition to Miss Lenna D. Swinerton who is one of the outstanding graduates. She began her study of massage under Dr. Douglas Graham and later took the course in Medical Gymnastics at the Posse School. She started a private practice giving a few hours a week to special cases at Perkins which was at this time located in South Boston. A little later she organized the department in corrective gymnastics. Because of her similar handicap, she was better able to understand the problems of the pupils and up until two years ago gave them her untiring efforts.

Miss Jennie M. Colby, another graduate of Perkins and classmate of Miss Swinerton's, should be mentioned at this time. She had a serious impairment of vision which would have kept many a person from such enterprises as she undertook. She has been called the parent of hydrotherapeutics in Boston. She devoted her skill for twenty-five years to the out-patient department of the Boston Children's Hospital. Her practice in massage and exercises not alone built up her reputation; for a number of years she carried on a gymnasium and some of her pupils have become well known to the profession. She died September 16, 1918. "She was not a money maker, but a minister; not a financier, but a philanthropist; not commercial, but professional: to her, life presented one clear calling, one definite thing to do; and to that she gave all her faculties and all her time, in the spirit of absolute consecration."

Taking these two lives as examples one will realize what can be done in this field by blind people, especially in the field of massage. "There is probably no more interesting school in all the world than Perkins. Cases of wondrous accomplishment grow there as thick as weeds."

A Resume of Some of the Current Concepts in Arthritis

L. Maxwell Lockie, M. D.

In the treatment of arthritis the physical therapist can be of great assistance to the physician. However, for successful cooperation, a clear conception must be had of the disorders included under the term "arthritis." The present brief article will include a general classification with particular emphasis upon the forms most commonly seen.

A satisfactory classification has been suggested by Allison and Ghormley for those types in which the etiology is known:

A. Traumatic Arthritis:
- Synovitis
- Loose Bodies and Cartilages
- Sprains, etc.

B. Bacterial Agent:
- Tubercle bacillus
- Gonococcus
- Staphylococcus
- Streptococcus
- Pneumococcus
- Typhoid bacillus
- Dysenteric
- Syphilis
- Influenza bacillus
- Rheumatic Heart Disease, etc.

C. Arthropathies:
- Tabes Dorsalis
- Syringomyelia
- Leprosy, etc.

D. Constitutional Disturbances:
- Gout
- Hysteria
- Hemophilia
- Intermittent Hydrarthrosis
- Anaphylactic Reactions.

When a joint condition is associated with one of the above, treatment is instituted to combat the underlying factors which are reponsible for the joint changes. After the exciting process has subsided, then physical therapy and orthopedic measures should be used in order to establish the best function possible. The particular procedure will, of course, be different for each patient.

There is one disease included under the heading "constitutional disturbances," which deserves further consideration. This is gout. The diagnosis of this condition is best made according to the criteria as set forth by Hench, which can be summarized as follows:

A typical history—that of recurrent arthritis of any joint—especially the big toe joints, knees, hands or wrists. There is complete recovery from the first attack in a few weeks, then another attack occurs, and again disappears completely in a few weeks. The average age at onset is forty years. But any person the age of twenty-five years, with an acute arthritis which subsides and recurs, should be studied very carefully for other evidences of gout, such as:

a. Elevated blood uric acid—Values above 5 mg

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per one hundred cc of blood are being considered abnormal.

b. The presence of tophi in the lobes of the ears, around the fingers, elbows and feet which is noted in over one half the cases. They consist of the sharp sodium urate crystals.

c. In some cases punched out areas appear in the bones and are easily seen in x-ray films. Normal bone has been replaced by sodium urate crystals which are not opaque to the x-ray.

Many of these patients suggest strongly infectious arthritis or rheumatic fever, and the correct diagnosis must be made as the therapy is very different from gout.

The various forms of chronic arthritis in which the etiology is unknown can be divided, as has been suggested by the American Committee for the Study and Control of Rheumatic Diseases, into two types.

Atrophic Arthritis

This occurs typically in a young individual. It often begins as a fusiform swelling in the fingers, extends to the wrists, then to the other large joints of the upper extremities. It may also begin in the feet or the knees. Usually the hips are involved last. There are many atypical cases which are grouped under this heading. The joints are usually swollen, warm, and there is a varying amount of limitation of motion. On active or passive motion they are painful.

A fairly high proportion of these cases follow an acute tonsillitis, sinusitis or pharyngitis. Fatigue, trauma, or shock may be predisposing factors. Frequently there is a history of undue fatigue for months previous to the onset of joint symptoms. The patients feel ill, the appetite is poor and often there is some loss of weight.

There is evidence also of a general infection. Many cases have a fever of a few degrees in the afternoon, with an increase in the total white blood cells and in the percentage of the young forms of the polymorphonuclear cells. There is an increase in the rate of sedimentation of the red blood cells.

In the hands of some investigators, streptococcus hemolytic organisms have been found in the blood in a fairly high percentage of cases. Similarly, they have obtained positive cultures from synovial fluids. Many workers have been able to find agglutinins in the blood serum of patients when they have used certain hemolytic streptococci as antigens. The significance of these agglutinins is not fully understood at the present time. Recently, precipitin reactions have been described as being specific for this disease.

The underlying pathology of atrophic arthritis consists in a formation of a pannus from the synovial membrane lining the capsule between the bone ends. This pannus is composed of inflammatory tissue with small round cells. Recently, it has been pointed out that these cells are arranged in a rather characteristic way. As the pannus touches the synovial membrane, it destroys the membrane and later the underlying cartilage. The pannus may form a fibrous or bony ankylosis between the bone ends. The muscles and subcutaneous tissue become atrophic. The bone structure gradually becomes less dense, and the joint space narrows.

There is no routine form of treatment to follow in cases of atrophic arthritis. Each patient is an individual problem. General procedures can be discussed under a few separate headings.

1. General care of the patient—This phase of the treatment is probably the most important, but is, unfortunately, often overlooked. The disease resembles a general infection with joint manifestations. Rest treatment for the arthritic is as valuable as for any patient with any other systemic disease.

The greatest and most lasting benefit would be obtained if the early cases could take a vacation of from twelve to eighteen months and live under ideal conditions in a climate where streptococcal infections are relatively rare. However, since most patients cannot afford to do this, and consequently a rest of an hour during the day and a good night's sleep is often the best that can be done. Body fatigue should be avoided for it will retard improvement.

Because of the chronicity of the disease, the patients become depressed and psychotherapy must be used. Experience has shown that the mental attitude of the patient markedly influences the course of the disease.

2. Elimination—Elimination through the bowels is most important. The colon becomes less active and the lumen larger as in other general infections. Definite instructions should be given to each patient.

3. Vitamins—These should be given in adequate doses. It has been thought that vitamin B in large quantities tends to establish greater tone in the large bowel. Preparations containing vitamins A, B and D are available. Orange juice or tomato juice form adequate source of vitamin C.

4. Diet—The diet should be so arranged as to keep the patients at average normal weight for their build. If they are over-weight a low caloric diet is indicated, and if they are underweight a high caloric diet should be used. A satisfactory basic diet consists of two vegetables, two fruits and a serving of meat or its equivalent each day.

5. Foci of infection—In early cases, marked improvement many times occurs after foci of infections are removed. The eradication of a focus after the patient has had the disease several years is usually of little benefit. It has been said that 90% of the foci are located in the tonsils, teeth or sinuses. Less frequently, the gall-bladder, appendix, prostate or pelvic organs may be the primary focus. In the early cases "questionable" or "suspicious" tonsils or teeth should be removed.

6. Vaccines—No other form of therapy has been more abused than the use of vaccines, but, correctly used, it forms an important part of the treatment. Because of positive blood cultures and agglutination reactions, a vaccine of streptococcus hemolyticus has been used the most. It is given in sub-reaction doses either subcutaneously or intravenously every four to five days for three to four months.

7. Exercise and prevention of deformities—Active exercise should be done at regular stated intervals, even when the patient is in bed. The amount of exercise should be inversely proportional to the amount of pain. The need of active exercise must be constantly stressed by the physician to the patient and those caring for him. Much patience is required to keep the joints in the best position. The weight of the bed clothes on the feet often causes marked deformity. Encouragement in moving of the joints is essential.

Corrections of back strain and foot strain are very important. Posterior splints for the knees help a great deal. Close co-operation with the orthopedic surgeon is necessary throughout the course of the illness.

8. Physical therapy—Ultra violet light is used to improve the general resistance of the patient. Radiant heat when used on the acutely swollen or painful joints ferquently gives considerable relief. Diathermy can be used with most benefit in the cases where the joints are

not as acutely involved. Gentle body massage increases the peripheral circulation and body tone.

9. Hyperthermia—

(a) Hot baths with the patient in a tub of water, temperature 104-106 degrees, for ten to thirty minutes often gives great relief. They should be repeated at intervals of two to three days. The body temperature will rise to 101-102 degrees F with this treatment.

(b) Short wave and radiant heat are being used with excellent results in some cases. The body temperature is kept up to 104 degrees for five hours. Occasionally the treatment is repeated. (In gonorrheal arthritis this form of therapy gives excellent results in 50% of the cases.)

10. Foreign protein—In the active febrile cases milk, typhoid, etc. are used to advantage.

11. Blood transfusions are beneficial in the anemic patients. Small repeated transfusions are the most helpful.

12. Climate has marked benefit in selected cases. The incidence of repeated infections is decreased and the patient is more comfortable in a warm climate. Six months or a year under proper supervision is the minimum time.

13. Drugs—

(a) Salicylates are the most satisfactory for the relief of pain.

(b) If the patient has a low metabolism, thyroid extract should be given.

(c) Iron in adequate doses is the best method for treating the anemia, which is often present.

HYPERTROPHIC ARTHRITIS

Hypertrophic arthritis usually involves fewer joints than atrophic arthritis. It is found typically in overweight individuals more than forty years of age. There is no evidence of generalized infection. Degenerative changes in the joints are present in a high percentage of older people who come to autopsy after death from any cause. It involves the knees, hips, cervical and lumbar spine most frequently. Many of these patients have Heberden nodes.

The changes in the joints begin as a fibrillation or splitting of the cartilage. This is cast off into the joint space. An over growth of cartilage from the opposite bone end occurs and may go on to such an extent that there is eburnation. These joints do not become ankylosed but crepitation is present, and occasionally they will lock. There is little change in the skin, subcutaenous tissue, or muscle around the joint.

The treatment may be considered under the following headings:

1. To reduce the trauma to the joint as much as possible. Moderation in the amount of activity. If the knees are involved, the patient should be cautioned against walking too much.

2. Weight—A great proportion of these people are over weight, and must reduce before they will improve.

3. Orthopedic measures—Backbraces and arches for the feet often help.

4. Constipation—Should be carefully treated.

5. Drugs—Thyroid extract should be given if basal metabolism is low. Salicylates are indicated for the relief of pain.

6. Heat—Radiant heat and diathermy are beneficial in selected cases.

This brief discussion is intended to attempt to bring together a few of the current concepts of "arthritis" which might be helpful to those interested in the medical side of physical therapy.

The Use of the Principle Suction Siphonage in Surgery

Gerald H. Pratt, M. D.

My subject is one which has held a foremost point in the development of surgical therapeusis of recent years. Whether such a subject would interest the physical therapist or not puzzled me, but from my past contacts with members of your society, I felt sure that anything new with at least a physical therapeutic basis would be welcomed by this group.

In surgery we are continually confronted with a very perplexing post-operative complication, namely, nausea and vomiting. The cause for this is a mild ileus or actually a mild intestinal obstruction, due to the trauma incidental to the unavoidable handling of the bowel during operation. In most cases this subsides spontaneously with that great healing duet—nature and time, and normal bowel activity or peristalsis is restored. In the exceptional case, particularly where infection is encountered or inflammation inadvertently set up, the ileus persists and a paralysis of a part or occasionally of all the bowel takes place. In this condition nothing moves through this portion of the bowel and we have a stagnation of the bowel contents with the accumulation of gas, putrefying food products, old bile, infectious organisms and large amounts of liquids. This leads to distention, great discomfort to the patient, nausea and vomiting, and the absorption of toxic materials from this paralyzed bowel with general signs of peritonitis.

The efficacy of gastric lavage as a valuable post-operative treatment for vomiting has long been recognized but the difficulty of passing large tubes and the added distress to the patient placed this in the category of last resorts. In 1916 Dr. White of Boston first noted the siphon effect of leaving a duodenal tube in patients with peritonitis. A certain proportion of this gas and fluid was thus removed. In 1919 Bassler, Jones and others reported good results with this method of treatment. Three years ago while visiting Dr. Wangensteen at the University of Minnesota, I was shown his method of overcoming distention by attaching the duodenal tube to a water suction. After considerable experimentation with this idea in Philadelphia, we developed the apparatus shown in Figure 1 for this purpose. By its use we were able to transform the mentally disturbed, irritable, uncooperative patient at once into a quiet, comfortable individual willing and eager to cooperate in every way. Only those who have had a similar experience can entirely understand this change. The gas and fluid distending the stomach and small bowel had been causing a bloated full feeling and a constant desire to vomit, a de-

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sire which when realized increases the incisional pain. These distended organs can be at once collapsed by this method with resultant immediate relief to the subject.

Dragsteadt in his experiments has shown that when the pressure within the intestine reaches 60mm. of mercury the circulation of that part of the bowel is blocked. When this pressure is reduced the circulation is at once resumed. This shows of course, why gangrene of the bowel results from the distention occurring in peritonitis. So, it is immediately apparent why reduction of the intra-intestinal pressure is very valuable in these conditions.

The ordinary suction of a pump or water faucet in the intestine would not be effectual because a portion of stomach or bowel might be drawn into the openings of the tube and cause an irritation to the mucosal lining. Therefore, it was necessary to devise a suction which would be effective only when there was liquid or gas in the bowel to be removed. To do this a very simple principle was utilized, that is, the negative pressure produced by the efforts of a column of liquid to flow from an elevated inverted container to a similar container at a lower level (Fig. 1—A and A prime).

A brief description of apparatus (Fig. 1). A and A prime are inverted gallon jugs suspended by a weighted pulley from a Murphy pole so that when jug A is raised, jug A prime is lowered. In each jug is a two-hole cork through which pass a long and a short hollow tube. The shorter tubes are connected together by a rubber tubing, the longer tubes lead to a three-way valve as shown in the figure. The third opening in this valve is connected to the collecting bottle, "C" in Figure 1. The water in bottle A prime desires to flow to bottle A by way of the connecting tubing but the water cannot leave bottle A prime until something displaces it through the long tube. Thus a suction is created in this long tube and is in turn transmitted through the valve to bottle C. The Jutte tube (duodenal tube) is then passed through the patients nose into the stomach and duodenum and connected to the bottle C as shown.—("B" in Figure 1 is also connected to the Jutte tube but is used only for irrigations and may be disregarded in this discussion.)

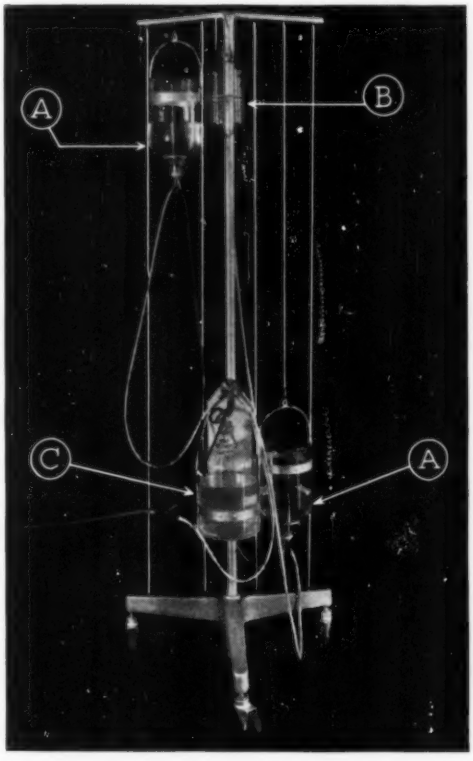

Fig. 1. Author's Evacuator. Apparatus as we use it today, eliminating changing of bottles. A and A prime Inverted glass jugs hung by pulley from Murphy pole, top bottle filled with water so longer tube just clears. When bottle A is up, bottle A prime will be down. From longer tubes in these bottles, rubber tubes lead to a three-way valve. Shorter aluminum tubes in bottles are connected to each other by a rubber tube. C. Collecting bottle, connected to three-way valve as shown. To this bottle Jutte tube is connected. B. Burette which connects to Jutte tube by Y-tube as shown. This tube is kept closed off when not used as an irrigator or for feeding. Note: Bottles are held in position by guy wires to prevent swinging when beings transported through hospital. Switch points to top bottle at all times.

(Fig. 1 is taken from Babcock Textbook of Surgery, M. B. Saunders Co.)

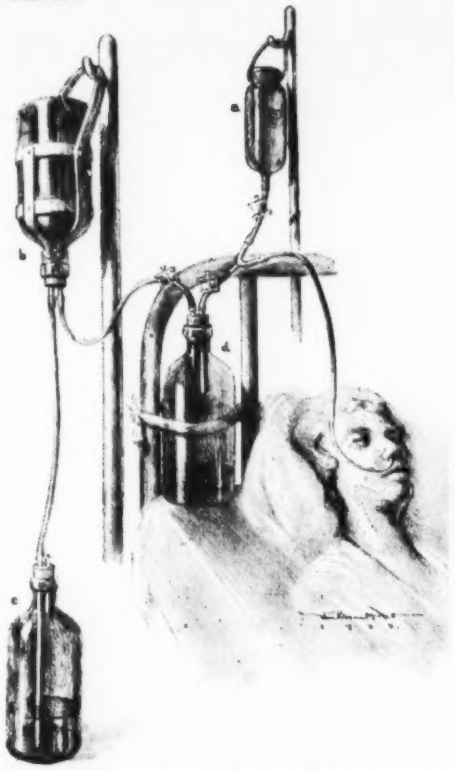

Fig. 2. Modification of original Wangensteen apparatus. Drawing shows duodenal Jutte tube passing from nose of patient to connect to longer glass tube in container (D). From shorter glass tube in (D) rubber tube leads to longer glass tube in filled, inverted bottle (2 gallon) (B). Note: Longer glass tube must clear fluid level. C. From shorter glass tube in inverted bottle (B) rubber connects to upright bottle on floor. A, Extra burette for cleansing tubes and later for nutrition. Note: Extra burette must be clamped off when not in use. When bottle B is empty, bottle C will be filled. Bottles can be exchanged by removing corks. (After Babcock.)

While colonic irrigations with various suction systems have been in use by physical therapists for some time, surgeons have been loath to allow the use of this type of therapy in post-operative lower bowel distention, due to the trauma of the irrigation and suction. The lower bowel distention occurring particularly after ruptured appendicitis is most disturbing at times and if this can be removed safely, the patient's chance of recovery is improved.

Having worked with this apparatus on numerous patients, it occurred to us this same procedure could be used in the rectum. It has worked even better than our fondest thoughts. It is applicable not only in the

distention due to peritonitis, but in cases of early intestinal obstruction in conjunction with the previously outlined treatment. Because the contents of the lower bowel are solid fecal materials, a small irrigation to start the evacuation is of prime importance. One must remember that in the development of an acute obstruction, swelling and edema and an increased intestinal pressure plays a large part. Where the obstruction is due to a cancer, the final closing of the bowel lumen is due to the swelling of the bowel wall. By removing the pressure due to gas and fluid above and below the point of obstruction this swelling is permitted to subside and with the help of the suction and small irrigations from below, together with the decompression above the obstruction point, the obstructed bowel contents can be evacuated.

What do we gain? The obstructed patient is in a very serious condition, one in which life may be very easily lost. Any operative procedure runs a high mortality. By overcoming the obstruction without operation the patient can be built up and prepared for a more complete surgical intervention. The mortality can be lowered at least to one-fourth. There are patients for whom the surgeon will decide immediate operation is necessary to save the bowel circulation, but there is a definite group in which this procedure will eliminate the emergency operation.

The distention of hysteria, pneumonia, acute dilatation of the stomach and various conditions of the bowel wall are all amenable to this therapy. This procedure has other applications to surgery which will not be discussed at this time. One of these, the overcoming of the biliary fistula, has caused a great deal of comment. Fecal impactions, a condition with which you are all familiar, can readily be handled with more safety. It is easy to visualize the period in the future when this procedure will be handled by the physical therapists under the direction of the surgeon. Their cooperation will be eagerly sought in cases of this kind, needless deaths avoided, and when operation is necessary, more complete and therefore more successful procedures performed.

I present this subject to you, not for adoption at this time, but merely to stimulate thoughts for the future of a growing profession, whose field will not only be enlarged by time but will become a more useful adjunct to surgery in general.

Figure 2, shows similar simplified apparatus easily constructed for one's office.

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Values of Individual Remedial Gymnastics for College Women

Gertrude Hawley

The motivation of college remedial classes is very different from the approach to physical therapy under hospital conditions or in medical clinics. Although we find in college cases of paralysis resulting from poliomyelitis and birth injuries, fractured joints, severe scoliosis, and other major orthopedic conditions, they are few in comparison with the number of individuals with faulty body mechanics and showing in mild degree such defects as kyphosis, lordosis, flat foot, and scoliosis. Such students generally exhibit no pathology which they consider important. Therefore, they lack the incentive that pain and discomfort provide for the correction of defects. In order to enlist their cooperation, an appeal must be made to them on the ground of some interest natural to their age and sex, supplemented by favorable environmental factors such as attractive gymnasium surroundings, convenient class hours, etc.

A practice common in colleges, which detracts from the effectiveness of the individual remedial work, is that of forcing students into these classes against their wishes. It may be argued that college students are not mature enough to realize the seriousness of neglecting defects of this kind, and that, therefore, attention to correction should be required of them; but such procedure often produces an emotional reaction against the work which defeats its whole purpose. If individual conferences are held by the physical education instructors and medical advisers for the discussion of defects found in the physical examination, all but a very small percentage of such students will be persuaded to enter these classes, especially if the social asset of good body mechanics can be stressed. Girls of college age are naturally interested in their personal appearance, and will go great lengths to increase their personal and social attractiveness.

The discussion which follows deals with a type of remedial work which employs exercise of a more or less formal kind rather than recreational, dancing and athletic activities. It is not the purpose of the writer to minimize the contribution of the latter to the establishment of muscular balance and correct body mechanics, but merely to present conditions under which individually prescribed exercises may be used to advantage in the

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correction of defects of an orthopedic nature. Such work should be supplemented by a varied program of rhythmic and athletic activities, in order that the individual may receive the social and moral training afforded by sports especially, as well as the more vigorous physical training and the improvement of the metabolic processes and physical endurance provided by such big muscle activities.

For success in individual remedial work, classes must be small, preferably not over eight students to one instructor, and equipment must be adequate. The room used should be attractively designed and furnished, with plenty of windows providing some sun during the day and so arranged as to give adequate ventilation without draughts. The latter feature is very important since a large part of the work is done lying on the floor. There should be enough mats to provide one for every student. A good size is ten feet square. Large and strongly constructed tables are needed by the instructor in special examination procedures such as measuring leg lengths and the like, and in devising special exercises for individuals. Such tables can be used also by students in performing certain of their exercises. They should be covered by durable, washable rugs since their bare surfaces are unpleasant to the student whose costume is, in all probability, a backless swimming suit. Other equipment needed for these classes includes mirrors, stall bars, stools, rings, plinths, devices to provide resistance in flexibility exercises, etc. Blankets of various sizes, preferably washable, should be provided for use as pads for pelvic and shoulder supports. The most desirable type of mirror is the large, permanently installed, wall variety with smaller, folding mirrors attached at the sides. If these mirrors are placed opposite each other in the room, practice in walking exercises is greatly facilitated.

At the beginning of the term, class procedure is difficult if all the students are new to the instructor. She must examine each one of them individually, checking with the physical examination record (in all probability the regular examinations will have been held several weeks or even months earlier) so as to determine for herself the severity of the defects which are to be treated. This takes the instructor's time and undivided attention, a condition which tends to cause impatience or boredom on the part of the majority of the class. Since, under usual college conditions of thirty-five to forty minute classes, five or six meetings of the class will be required to provide every student with her individual prescription of exercises, it will be found necessary to devise some means of keeping the class busy and interested. To bridge over this awkward period the instructor may provide reading material pertinent to the subject of posture, give short talks on the significance of the work to be undertaken, and teach a uniform series of simple exercises as group work, the latter to be superseded by individual exercises as time goes on. By the beginning of the third week every student will have learned a program of exercises chosen for her particular needs, and from that time on, most of the instructor's time should be devoted to work with individuals before the mirrors, teaching them how to poise the body in standing and walking so as to correct their faults without undue strain. This would seem to be the supreme function of the instructor after the first week or two when the confusion inherent in starting the work of the class has subsided. It is the practice in poise which will eventually produce habits of correct carriage of the body, provided the tonus of weak muscles can be improved and antagonistic structures stretched.

Poise must be learned as an entity, and can best be taught standing before the mirrors. Starting with the pelvis, the instructor should focus the student's attention first upon the necessity of "unlocking" the knees from the position of hyperextension in order to permit the proper inclination of the pelvis by contraction of the gluteal and abdominal muscles. Next, attention must be directed toward raising the chest, thus making it possible to bring the head and neck into their proper positions without undue strain. Finally, the student is assisted to secure the best carriage of the shoulder girdle without straining into excessive adduction and elevation of the scapulae (the inevitable results of attempts at correction made by the individual if unassisted). When the student has thus learned a proper standing position, she should practice walking, holding the correction, with frequent self-observation in the mirrors and helpful criticism on the part of the instructor. This type of self-corrected standing and walking is an essential part of the class work if permanent improvement in posture is to be gained.

Considerable space has been given to discussing general problems of class management because, without proper attention to them, our efforts may result in failure even though techniques for the treatment of specific defects may be scientifically sound and carefully worked out. Now let us turn our attention to the types of cases which can be treated successfully by individually prescribed exercises.

Postural defects in the antero-posterior plane of the body are most commonly found among college students and will be discussed first. A forward position of the head is almost invariably a part of this picture and the problem of correction it presents is a difficult one. It is generally the easiest of all defects for the students to remedy while under inspection in class, but an erect carriage of the head is one of the hardest things for them to attain as a part of their habitual posture. This defect cannot be corrected alone by backward moving of the head but, rather, the chief emphasis must be placed upon lifting the chest. The muscles of the anterior aspect of the neck in such individuals, for example the sterno-cleido-mastoid and anterior scalenus, have become shortened in relation to the posterior muscles of the neck, and it is only with great difficulty that they can be lengthened sufficiently to permit an erect carriage of the head if the upper ribs to which they are attached are held in too low a position. If corrective procedure is directed toward extension of the thoracic spine with its accompanying elevation of the ribs and sternum, the neck will assume a more vertical position without undue strain upon the anterior neck muscles. By choosing exercises for elevating the thorax instead of those requiring extension of the cervical spine, an undesirable feature of the latter is avoided, namely a strained appearance of the neck and especially the "double chin," which always arouses in the student the fear that it may become permanent.

The erect position of the head accomplished in this manner through the elevation of the upper part of the thorax will provide an important factor in the correction of an all-too-frequent accompaniment of faulty posture, visceroptosis. As K. Rambo has pointed out in a recent issue of the Physiotherapy Review,[1] the height of the organs of the abdominal cavity depends to a large extent upon the height of the diaphragm the central tendon of which, through the pericardium, is suspended from the cervical fascia. For the diaphragm to assume a position high enough to provide room for the liver and stomach in their normal relations, not only must the

ribs to which the diaphragm is attached be held in moderate elevation, but also it must be adequately supported from above. This support is provided by a taut condition of the cervical fascia, generally assured by an erect carriage of the head.

Correction of visceroptosis, so far as individual remedial classes is concerned, falls under three headings: first, improvement of the position of the chest; second, development of strong abdominal muscles; third, the relief of strain upon the ligaments and fascia which suspend the organs. The latter is accomplished by recumbency but more effectively by what may be called the "inverted lying position." The individual lies on a board inclined about thirty degrees from the horizontal, with the shoulders and head resting on the floor and the trunk and legs elevated. Such a position produces a reversal of the usual pull of gravity upon the suspensory ligaments of the organs. If this position is assumed for considerable periods of time (by elevating the foot of the bed upon which the individual sleeps with blocks of wood, this factor in correction can be made truly effective) the organs may be expected eventually to assume a higher position due to the shortening of the suspensory ligaments. In the inverted lying position exercises for strengthening the abdominal muscles may be taken, thus providing greater support for the organs anteriorly. Students with the condition of visceroptosis will have been referred to the instructor of remedial classes by a doctor, and exercise treatment of such cases should not be undertaken except on the advice of a physician.

Thoracic kyphosis may be classified for the purpose of treatment in remedial classes as, first, a condition of atonic muscles of the back with normal flexibility of the spine and thorax, and second, semi-rigidity of the spine in a position of excessive backward convexity with or without normal tone of the back muscles. The former is extremely common among college students and is often only one of many symptoms of malnutrition. In remedial classes much can be done for these individuals by carefully prescribed exercises to strengthen the extensors of the spine, retractors of the scapulae and elevators of the ribs; but unless the causes of malnutrition also receive attention our efforts will in all probability be wasted. Some degree of rigidity is also found in college students with excessive thoracic kyphosis. For this condition various forms of suspension and resistance exercises must be devised for the stretching of contracted structures in order to make the work of strengthening the weak muscles effective. Some of these cases if x-rayed would undoubtedly show vertebral bodies anteriorly wedged to account for the kyphosis. In spite of the discouragement connected with efforts for these individuals, the condition should not be ignored because, if allowed to go untreated, unnecessary deformity will result from undue shortening of ligaments, muscles and tendons.

The correction of scapular abduction and tilts can be highly successful if the proper method of instruction is used. Folding mirrors and excellent lighting are necessary for the individual kind of work needed. No two persons are alike with respect to the way in which the scapulae are held, and while an absolutely flat position upon the ribs is possible for some, others will not be able to assume that position without undue strain and fatigue. The instructor must aim at the amount of correction which in the end can be made and held without conscious effort or muscle strain. Exercises for improving the tone of the scapular adductor and seratus anterior muscles are very valuable, but equally important is self-correction before a mirror, sitting and standing, with the aid of the instructor, followed by walking while maintaining the scapulae in their proper position.

Lumbar lordosis with an abnormal degree of pelvic obliquity and prominent abdomen are present in a large percentage of college girls. In most cases hyper-extension of the knees is also present. It is possible that an abnormally short tendon Achilles or undue tonus of the calf muscles will be found to account for this "back knee" habit and in such cases stretching exercises will be needed in order to make possible proper body mechanics in this region. Then, by strengthening the abdominal muscles and learning to stand with the gluteal muscles in moderate contraction, the pelvis may eventually be brought into an habitual position of normal obliquity. The so-called "wall exercise"[2] is indispensable for training the coordinations necessary in correcting this combination of faults. A large movable mirror set at an angle with the wall mirrors will be useful to the students for practice in walking while holding the pelvis and lumbar spine in proper alignment.

In the treatment of scoliosis by exercise the efforts of the student and instructor should be directed primarily toward the restoration of body equilibrium. In such cases there exists practically always more or less lateral displacement of the body above the pelvis, due to the spinal curvature and rotation. Although the individual unconsciously makes an effort toward compensation by twisting and bending the trunk above or below the primary curve, she is generally not successful in attaining a posture of perfect balance without special instruction. Exercises the purpose of which is to produce derotation, and to reduce the lateral deviation of the spine, may be used but, according to Dr. Arthur Steindler,[3] the most important thing in arresting the deformity is to work for perfect compensation, that is, equalization of the weight on both sides of the median plane of the body above the pelvis.

A simple device may be used for measuring the amount of lateral body displacement, as follows: a plumb line is hung in front of a large mirror upon which, by means of an eye-brow pencil, parallel lines are drawn 1, 2, and 3 cms. from it, respectively, on either side. The examiner stands on a stool facing the mirror, the student immediately in front of her on the floor with her back to the mirror. If the student and examiner are in proper positions with relation to the plumb line the image of which must coincide exactly with the line as seen by the examiner and at the same time must fall midway between the feet and coincide with the cleft of the buttocks, it can be seen clearly by the examiner whether there exists lateral body displacement above the pelvis, and, in a rough way, how much and in what regions. This method of estimating displacement is preferable to the usual one of holding the plumb line at the cleft of the buttocks or midway between the feet because the hand of the examiner inevitably wavers while she is giving her attention to the study of the body contours. The mirror test described is only a rough measurement, but if the same scale is used in repeated examinations observations will be comparable and improvement can be noted.

The training to be given to an individual who shows lateral body displacement consists in self-correction facing a mirror with the attention especially directed toward the height of the shoulders and the lateral body contours in the region of the hips and pelvis. Inequalities in the two "waist triangles" are easily noted by the student and give her a concrete idea of what she is trying to accomplish as she shifts the trunk sideward. When she has learned to stand and walk holding the body in such

a position as to make these triangles similar and the shoulders equal in height, it will be found that she has overcome the lateral displacement according to the test above described. The image of the plumb line will be seen to bisect the neck region as well as the pelvis. The actual measurement of the weight on twin scales, as used to determine lateral body displacement, has not been successfully applied by the writer due to the tendency of the person being tested to sway from one foot to the other. While this is a factor to be taken into account in the mirror test also, it is not so serious here because the examiner is better able to make allowance for it.

In addition to the training and testing described above, certain exercises to increase flexibility and to improve the tone of the muscles responsible for holding the corrected position must be given. A word of warning here is necessary because, if flexibility exceeds the development of muscle power to hold the corrected position, in the long run our efforts will have been wasted, since a return to the original deformity or possibly even the development of further maladjustment is a foregone conclusion. It is probably better to have perfect compensation in the spine and thorax even though they may be somewhat distorted than to develop instability which will lead eventually to greater deformities. However, in mild functional curvatures the asymmetries will generally disappear completely as a result of postural training to develop the tone of the trunk muscles and a sense of poise and balance, although, as in all kinds of poor posture, the causes of the defects must be ascertained and removed in order to achieve permanent improvement. It is essential to have the advice of an orthopedic surgeon when exercise treatment of structural scoliosis is undertaken.

Whether or not treatment of foot conditions will be successful depends primarily upon the interest of the student in making the correction. Generally speaking, under college conditions, it is time wasted to attempt correction of low arches and pronation unless the student is suffering discomfort from them. We have no adequate criteria for determining what is normal for the individual and small basis for predicting trouble in the future. However, for the person who complains of pain, undue fatigue, or discomfort, much improvement can be expected to follow treatment in the form of daily exercises, proper alignment of the thighs, correct habits of walking, and properly designed and fitted shoes. Many cases of foot strain accompany the lowered vitality due to malnutrition, and it is important to eradicate the underlying cause as well as to treat the foot symptoms. This also applies to overweight individuals whose arches may be low as a result of the excessive weight constantly borne by them.

It has been too much the tendency in exercise treatment of the feet to fix the attention upon isolated conditions such as a painful anterior arch rather than to treat the foot as an entity. J. Kellett-Smith[4] has emphasized the fact that strain of one of the arches in most cases means strain of both, and that pronation is generally a part of the same picture. Dr. Lowman[5] has pointed out the relation of inward rotation of the thighs in the standing position to low longitudinal arches and pronation. When this mal-alignment of the thighs and knees is present the thrust of the body weight is downward into the medial part of the foot rather than the mid-region where it should fall, causing the longitudinal arches to be lowered and the inner malleoli to become more prominent. By improving the tone of the outward rotators of the hip joints the longitudinal arches will assume a higher position and there will be less pronation.

With these basic principles in mind, treatment in the form of foot and leg exercises can be expected to relieve symptoms from which the individual is suffering unless there is marked deformity present. It is essential that foot exercises be done daily over a period of several weeks or even months, depending on the severity of the symptoms and strain. If exercises which employ the principle of inversion of the feet have been performed over a sufficient period of time, not only will the foot discomfort have been alleviated but the longitudinal arches will have assumed a position five to ten millimeters higher than at the beginning.

In closing, the fact should be emphasized that faulty posture is a composite picture due to poor body mechanics, and must be treated as an entity in order to achieve lasting results. We may break it up into its component parts for the sake of more effectively attacking the several conditions found, but the muscle reeducation necessary must also include a great deal of posture training under conditions of sitting, standing and walking.

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The New England Peabody Home for Crippled Children

Edna L. Goodwin

How best describe it? To me it is a place of sunshine, fresh air, and happy children. This was my first impression when becoming associated with the Home four and one-half years ago. The years have confirmed that impression, and it is, in truth, a reality.

A short resume of the history and progress of the Home may be of interest. From an old report we learn that only forty years ago there was no place in New England devoted to the care and education of crippled children. A crippled child needed a home. There was no place for him but the almshouse at Tewksbury. Mrs. H. M. Peabody became interested in that child. This combination of circumstances accounts for the founding of Peabody Home. It was through Mrs. Peabody's efforts that money was raised to lease the "Davis Farm" in Weston, Mass., where the Home was formally opened on June 2, 1895, and started with a family of seven children. In 1900 it was possible to move to larger quarters, through the gift of a piece of property in Hyde Park, Mass. The new place was better equipped for the care of the family, which had by this time increased to twenty children.

In 1904 a new Home was built on this land. Here

New England Peabody Home for Crippled Children.

heliotherapy treatment for bone and joint tuberculosis was begun in 1913. Here the out door school was first tried, and classes in manual training and domestic science were carried to a high point of efficiency. The children were given the training and environment best suited to help them face life as self supporting men and women. Thus for eighteen years a worth while work was carried on in the Home at Hyde Park, but more room was needed. Epidemics of infantile paralysis greatly increased the number of crippled children, and the Home was filled to more than capacity. Many children had to be refused admission because of lack of accommodation. The family had outgrown its quarters.

In 1922 a new Home was provided through an unexpected and generous bequest. This is the Home with which we are familiar today. It is situated on Oak Hill in Newton Center, Mass., high above the surrounding country, with an unobstructed view of the Blue Hills in the distance. This site was originally the private estate of the late Dr. Henry J. Bigelow, professor of surgery in Harvard University Medical School. It comprises a tract of land over forty acres in extent, and covers the entire top of the hill as well as the east, south, and southwest slopes. Beautiful trees and shrubs abound. A pine grove provides an excellent playground for the children; it is equipped with swings, merry-go-round, jungle jim, slippery slide, teeters, and boxes, and play house. It is a happy day when a child is able to join the "Up" group and go out to the playground.

The Home is really a combination of home, school, and hospital. It is an orthopedic hospital in good standing, inspected and approved by the American College of Surgeons and by the American Medical Association. All necessary surgical operations are performed in our own operating room. We have modern x-ray equipment, and facilities for doing the routine clinical laboratory examinations. A well equipped dental room is another important item. A dentist comes one day a week to care for the children's teeth. Eyes are examined periodically by an ophthalmologist. The report of the oto-laryngologist might be of interest:

> The activities of the Ear, Nose, and Throat Department have been extremely limited due to the absence of ear, nose, and throat complications during the past year. A unique clinical observation is the atrophy of lymphoid tissue in these children after being patients at the Home.
>
> With the good hygienic surroundings, proper diet, regular hours and systematic supervision, the hypertrophied tonsils shrivel and the adenoid tissue disappears.
>
> The longer the patient stays at the Peabody Home, the less is the necessity for a tonsil and adenoid operation.

At the present time there are eighty-six children in the Home. Seventy-six of these children have bone and joint tuberculosis. The Home, thanks to its situation on a high terrace which hugs the southern side of the hill, is particularly well adapted to the care and treatment of this disease. The porches face east, south, and west, and have sunshine all day long. Those of the children who are confined to beds or frames live on the porches day and night. In the summer these porches are open and screened; in the winter they are enclosed with Vita and Corex glass, thus providing both heliotherapy and protection from the cold. Except in very severe weather, patients are wheeled out on the open terraces for short periods daily during the winter. Treatment includes an abundance of fresh air and sunshine.

I will outline briefly the treatment of tuberculous spines, hips, and knees, as followed here at Peabody Home. In the first place, parents must agree to leave their child in the Home for at least two years. It takes time to heal a tuberculous lesion. Treatment may be considered under the headings of general and local care

for cases in the acute and quiescent stages. Tuberculosis is a destructive disease. All treatment airs to check the destructive process.

General treatment is the same in both acute and quiesent stages. This includes rest, recumbency, heliotherapy, fresh air, and nourishing food. Local care provides fixation of the affected part in the acute stage. Tuberculous spines are put in hyperextended plaster shells to prevent kyphosis or to prevent an increase in an existing kyphosis which is caused by the collapse of the vertebral bodies due to the destructive process of the disease. The hyperextended position tends to spread the bodies of the vertebrae, and prevent further destruction which would result from pressure or weight bearing. Generally speaking, a child lies in his anterior shell during the day and is turned into his posterior shell for the night. He has a go-cart, which is the only bed he knows. It serves as his automobile as well, for it carries him from porch to school room, or to whatever part of the hospital he may need to go. A Bradford frame is securely fastened to the go-cart. Pelvic bands and cross shoulder straps pass over the child and under the frame, thus keeping him, in his shell, in place on the go-cart. Pillows are placed under the front of the shell to hold it steady, and also under the child's lower legs to prevent hyperextended knees and tight heel cords. X-rays of local lesions are taken every three months. Chest plates are taken every six months and chest conditions are carefully watched.

Acute tuberculous knees and hips are put on adhesive traction on Bradford frames. Whenever the traction is changed, or if any skin irritation is noted, a stocking extension is applied. This gives the skin a rest from adhesive. Although children are continuously on traction for many months, a sore, bleeding leg is a thing unknown here.

In the quiescent stage, the mechanical fixation of the joint is continued, and physical therapy is started to improve muscle tone, often with surgical fixation in view. Exercises consist at first of muscle settings, and progress through guided active, to active exercises. Hip cases start with quadriceps setting, gluteal settings, and foot exercises, and gradually progress to active exercises in hip extension, abduction, and flexion, knee flexion and extension, and foot exercises. Patients are watched very carefully for any signs of muscle spasm. If any are noted, exercises are discontinued and the fact reported at once. If there is no reaction, exercises are increased. After a period of from six months to a year of physical therapy, the child is ready for operation. After surgical fusion the hip is put in a long plaster spica. Physical therapy is resumed about four months after operation. Then it is a question of strengthening the muscles and teaching the child to walk. He begins walking in his spica with the aid of crutches. These are finally discarded, for a fused hip needs no apparatus. Foot weakness and poor habits of walking must be watched and corrected. It is a long, slow procedure, but it has its rewards. It is fun to have a part in getting up on to his feet a child who has not walked for from four to eight years, if ever.

The spine cases have exercises for about a year before fusion. These consist of the three count hyperextension exercises—contracting the abdominal muscles on the first count, the gluteii on the second, and the erector spinal on the third; hip extension, and foot exercises. The children enjoy doing these exercises in groups. All spine cases are gotten up on their feet and walk in their Ghormley jackets, before fusion. After fusion they are fitted with Taylor back braces when they are ready to begin walking. Then the story begins all over again, but it is much easier for them to learn to walk the second time.

This work is done with the help of students from the Bouvé Boston School of Physical Education.

Perhaps this use of physical therapy in the treatment of bone tuberculosis has not been stressed as much as it should be. We find much in medical literature on the value of heliotherapy and its effect in increasing the resistance of the individual to the tubercle bacillus. Surgical fusion has its established place in effecting an ultimate cure. Now, may we claim a place for physical therapy as an important aid in the rehabilitation of those afflicted with bone tuberculosis.

Errors in Physical Therapy Technique

Margit Aden

In a large and busy clinic all sorts of new ways to treat and handle patients are developed from time to time. Most of the time the new technique does mean increased efficiency and a saving of time, but occasionally one is suddenly confronted with a firmly-entrenched routine that is not a sound deviation from the text book technique at all.

We all need a warning not to go on blissfully doing the convenient and the usual thing. Ever so often we ought to stop and take stock of ourselves. Are the things we do in physical therapy not only time saving, labor saving, and apparently efficient, but are they also absolutely correct?

From looking at other technicians as well as at myself I now and then find a few little rules and laws forgotten for the sake of routine.

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Take for instance such a simple thing as the administration of surface heat: infra-red, radiant light, etc. We know that a relatively short application of heat should be used in cases of circulatory sluggishness (which includes all flaccid paralysis cases) where we want a quickening of the circulation, that is rapid vasodilatation. And we also know that a long and quite intense heat application should be given in cases of spasticity (Little's Disease, cerebral hemiplegia etc.) because in these cases we are not particularly interested in speeding up of the circulation, and certainly not in the increased stimulation of nerve and muscle function, but are wholly interested in the attempt to relax the spastic muscles through the nerve endings. It requires a long time and much heat for the completion of this relaxation. To give the same amount of heat in these different conditions is an inexcusable practice. But time and time

again the flaccid paralysis case receives a long, intense heat application with resulting congestion, secondary anemia and collapse of blood vessels, coupled with relaxation of muscles and nerve sluggishness, and the spastic case gets a good dose of stimulation because of altogether too short and insufficiently intense heat.

It is also easy to forget that when a bridge or a lamp for instance does not cover the whole lower extremity, the radiation must begin at the central parts and end at the distal parts and not vice versa. In massage of an extremity, this rule is even more important; the blood vessels in the central parts must first be opened up before we can hope to effect complete drainage of the distal parts.

Most of us forget to include a large enough surface area to be treated in a given pathology. That we allow for more surface when we apply radiant heat and massage than when we apply diathermy is true enough, but to my mind we are not generous enough with either. For, to take an example, in a unilateral sacro-iliac strain the patient usually receives radiant light and massage of the lower back on the diseased side when the middle as well as the whole lower back should be included together with the gluteal muscles and the upper thigh. The diathermy electrode is usually very much too small, covering practically only the sacro-iliac joint itself with a somewhat larger abdominal electrode. This faulty diathermy technique is excusable because the text books in electro therapy stress the fact that diathermy is a direct local heat application. That diathermy necessarily is a local treatment is a fallacy. That it is a concentrated and deep-affecting method of giving heat, I agree with. What one ought to stress is the need of including as large an area as it is technically advisable between the two diathermy electrodes in order to affect as much of the adjoining circulatory channels as possible. How much can the circulation really be affected by an electrode, on top of the sacro-iliac joint the size of two by two inches; or a subdeltoid bursitis by an electrode of one square inch; or a hip joint by a three by four inch electrode? Certainly very little. Therefore let us use as large electrodes as we can without producing edge-effect, and on bony parts let us insist on getting large parts of the surrounding soft tissues (that contain the large blood vessels) included in the electrodes.

According to most writers on physical therapy it does not matter where exactly the dispersive electrode is placed when giving interrupted galvanic or faradic current to a weak muscle. Most technicians therefore put the dispersive electrode where it is most conveniently held in place, and almost without exception one will find the dispersive electrode under the calf muscles when tibialis anticus is to be stimulated into contraction; under the hamstrings when the quadriceps is to be stimulated; under the volar surface of the forearm when the dorsal flexors and finger extensors are to be stimulated, etc. In other words, weak and paralyzed muscles are stimulated simultaneously with their antagonists.

Now, as soon as a muscle is partially paralyzed it needs complete relaxation on the part of its opponents to perform any movement at all. Simultaneous stimulation of its antagonists does therefore not only prevent the desired motion, but gives an actual contraction of these antagonistic muscles and further weakens and stretches the paralyzed muscle, increases the tone of the already hypertonic state of the opposing muscles, and accentuates the existing contracture deformity.

I have seen this done repeatedly by intelligent technicians. They are perfectly conscious of the spreading over of the current to the antagonists, but because this phenomenon occurs also when the dispersive electrode is as far as a yard away from the active electrode, they think it is unavoidable. I believe it is harmful under any condition to employ an electrical stimulus to a weak muscle when the stimulus jumps over on the strong antagonists. But by employing the correct technique (the dispersive electrode away from the antagonistic muscles) the jumping over phenomenon is often eliminated, and so it is advisable to use the electrical stimulation when otherwise this therapy would be contra-indicated.

A great many physicians prescribe galvanism in spastic cases, specially in cerebral hemiplegias. The only reasonable way to go about treating these cases with the galvanic current is to try to get contractions of the unaffected muscles (the antagonists of the spastic muscles). I have tried this many times but I always get a strong spreading of the current to the spastic muscles with resulting increase of the spasticity. It should therefore be made a rule that electrical stimuli are contra-indicated in spastic conditions.

It is fast becoming a routine to give hydro-gymnastics to various forms of spastics. Why any spastic should be given this form of therapy, I have never been able to understand. The water, for one thing, is never of high enough temperature to cause relaxation of spastic muscles. And, for another thing, the water is particularly incentive to play and distraction. Not only this, but it is actually more difficult to co-ordinate movements in the water because of the lack of a stationary and solid base which creates continual changes of position. The spastic patient must not only try to combat his lack of co-ordination in performing a specific movement but he must also learn to overcome the buoyancy that perpetually changes his equilibrium. We know that it is difficult enough for the spastic to co-ordinate his movements without adding a new obstacle, which he does not need to overcome at all in his daily life.

Of course we have established beyond question the fact that a weak muscle can accomplish a movement easier in the water because of the buoyancy, but it is just as obvious that co-ordination in the water is more difficult. So why give spastic cases hydro-gymnastics?

Polio patients (having treatment in therapeutic pool) who have regained their muscular power sufficiently to require strong resistive exercises should be taken out of the pool and be treated in the gymnasium with regular muscle training. As soon as the recovery has reached this stage the buoyancy can not be utilized, and we are faced with the spectacle of first eliminating a certain amount of resistance to movements and then, and at the same time, adding resistance to them again.

When the technician cannot give sufficient fixation of the patient's joints and cannot apply enough resistance because she must use her muscles to anchor herself, then the treatment becomes an injustice to the patient.

Posture work in the pool is practically useless, unless the patient's trunk muscles are extremely weak so an upright position can be maintained only with difficulty, and some sort of general, partly assistive, exercises in the form of trunk rotation and lateral flexion, head raising, etc. from a horizontal position are the only possible movements to be had.

Hydro-gymnastic treatment is a new physical therapy modality that has been glorified in the press, pseudo-scientifically expounded over the radio, hugged to the heart by all of us with the result that we clutter up our pools with many patients who do not belong there at all or we keep them there after the indication for the treatment is gone.

Upper Motor Neuron Lesions

An Analysis of the Syndromes of the Motor and Premotor Areas

J. F. Fulton, M. D., Henry R. Viets, M. D.

When confronted by a patient exhibiting loss or impairment of voluntary power, a clinical examiner sets about at once to determine whether the disturbance is in the muscles themselves or in the nervous system. The case history generally indicates which one is involved, and if the trouble proves to be nervous in origin, the next step is to decide whether the central or peripheral nervous system is primarily concerned. In current neurologic teaching a broad distinction is made between the paralyses resulting from lesions of the "lower motor neuron" and those due to interruption of the "upper motor neuron." The lower motor neuron has its beginning in the cells of the anterior horn and its ending in the skeletal muscles. The term upper motor neuron has reference to the pathways from the cerebral cortex conveying volitional impulses, directly or through intermediate neurons, to the anterior horn cells of the spinal cord.

The symptoms of lesions of the lower motor neuron, such as occur in poliomyelitis, are identical with those produced by cutting a motor nerve; that is, voluntary power is completely destroyed in the affected muscles, reflexes are abolished, the affected extremity is flaccid, and electrical stimulation reveals the typical "reaction of degeneration" table 1). Contractures and other deformities are prone to develop, owing to unopposed action of nonparalyzed muscles.

The conventional distinctions between upper and lower motor neuron lesions are indicated in table 1 (after Campbell Thomson and Riddoch[1]). The symptoms of lesions of the upper motor neurons are, however, much less uniform than is indicated in the table, and considerable confusion exists as to their nature. This is due in large measure to the fact that lesions observed clinically seldom involve a single projection system. Furthermore, previous physiologic studies bearing on the subject have generally not been described in clinical terms, and their significance has accordingly escaped notice. It is therefore proposed in the present paper to interpret the upper motor syndromes of clinical neurology in the light of recent neurophysiologic investigations on monkeys and the higher apes, the terms of clinical literature being used for descriptive purposes.

Cortical Projection Systems Responsible for Voluntary Movement

In the past, the upper motor neuron has been identified solely with the pyramidal tract in the erroneous belief that voluntary reactions are mediated only through the corticospinal pathways from the motor area.[2] From observations on man and chimpanzees it is now known that the region of the cerebral cortex lying anterior to the motor area,[3] generally referred to as the "intermediate precentral" or "premotor" region and shown in the accompanying illustration, also mediates voluntary reactions through its own corticospinal tracts or through its subcortical connections. In monkeys and chimpanzees from which the motor areas have been completely removed and the pyramidal tracts degenerated, voluntary movements of a fairly high order of complexity are eventually regained. When the premotor areas are also removed from both cerebral hemispheres, these movements disappear and the animal becomes permanently paralyzed. In any consideration of the upper motor neuron, therefore, one wishes to know to what extent the lesion involves the pyramidal pathways from the true motor area, and to what extent the nonpyramidal premotor pathways. This can be readily ascertained through a knowledge of the symptoms produced by isolated lesions of the motor and premotor areas respectively. Section of the pyramids themselves, as for example at the decussation, cannot answer the question, for it has recently been shown that corticospinal fibers from the premotor area actually pass to the spinal cord along with the pyramidal fibers of the motor area.[4]

Table 1.—*Upper and Lower Motor Neuron Lesions as Conventionally Contrasted**

	Lesion of Upper Neuron	Lesion of Lower Neuron
1. Wasting	Slight	Marked
2. Reflexes	Deep increased Babinski present	Abolished
3. Rigidity	Spastic	Flaccid
4. Electrical reactions	No change	"Reaction of degeneration"
5. Contractures	Marked and according to set patterns	Irregular

*After Campbell Thomson and Riddoch.[1]

Experimental Lesions of the "Upper Motor Neuron"

A. Ablation of the Motor Area.—When the cells of origin of the pyramidal tract are removed in man or chimpanzee by ablation of the motor area, the affected extremities exhibit complete paralysis of voluntary movement for a period varying from two days to a week.[5] During this period the limbs are flaccid with depressed or absent reflexes, and marked wasting of the muscles is likely to set in. There is no vasomotor disturbance, however, and no gross change in electrical reactions, though the excitability as determined by chronaxia measurement is said to be altered.[6] Voluntary motor power begins to return, generally within the first week, appearing first at the hip and shoulder, then at the knee and ankle, and finally in the digits. At no stage during the recovery of voluntary power in the chimpanzee do the extremities become spastic; deep reflexes generally reappear when voluntary power returns, and the knee and biceps jerk may in the course of time become somewhat hyperactive, even though the extremities themselves remain flaccid. The Babinski and Chaddock reflexes develop when the deep reflexes return and remain permanently present,[5b] while the fanning sign of Babinski and the Hoffmann and Rossolimo reflexes are absent (table 3[7]). A pure motor area lesion causes no "intellectual" deficit, that is, no loss of memory or mental confusion, even when bilateral.[8]

B. Premotor Lesions.—Following isolated removal of the premotor area, profound motor disability occurs, which lasts, both in man and in the chimpanzee, for four or five days. Immediately after such a lesion, however, the affected extremity becomes highly spastic; no wasting occurs, electrical excitability is normal, and certain characteristic pathologic reflexes, such as forced grasp-

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ing, the fanning sign of Babinski and the signs of Rossolimo, Mendel-Bechterew and Hoffmann, develop (table 3). There is also profound vasomotor disturbance, the affected extremity losing for a time its power of reflex vasodilatation and sweating.[9] Voluntary power begins to return simultaneously in all parts of the extremity, generally from four to five days after the lesion, but skilled movements, such as those necessary to play the piano, to "finger" a violin or to tie a shoe-lace, become permanently impaired and the impairment can be demonstrated long after such a lesion has occurred. Spasticity, forced grasping and vasomotor disturbance, however, tend to disappear with the return of voluntary power.[7a] In chimpanzees these symptoms reappear in all four extremities when a premotor lesion is made in the opposite hemisphere. This indicates the existence of bilateral representation in each hemisphere.[10]

Following premotor lesions there is some "intellectual" deficit in that the "memory" for acquired skilled movements is lost, but reeducation is possible.[8]

C. Combined Motor and Premotor Lesions.—When the motor and premotor areas are simultaneously removed from one hemisphere, the affected extremities are at first flaccid with depressed reflexes (pyramidal tract effects); but strong spasticity, reflex exaggeration and vasomotor disturbances are prone to develop within three or four days (nonpyramidal premotor effects). The signs of Babinski, Chaddock (pyramidal), Rossolimo, Mendel-Bechterew and Hoffmann together with the fanning sign of Babinski (nonpyramidal) are likely to be permanently present (table 3).

TABLE 2.—*Symptoms of Voluntary Paralysis*

	Upper Motor Neuron Lesions		Lower Motor Neuron Lesions
	Pyramidal (Motor Area)	Nonpyramidal (Premotor Area)	(Anterior Horn Cells or Peripheral Motor Nerve)
1. Rigidity	Flaccid or normal	Spastic	Flaccid
2. Deep reflexes	Depressed at first	Greatly augmented	Abolished
3. Superficial reflexes (lower limbs)	Flexor exaggeration with Babinski	Extensor exaggeration	Abolished
4. Muscular atrophy	Marked	None	Very marked
5. Electrical reactions	Transient ? depression	No change	"Reaction of degeneration"
6. Contractures			
Lower limbs	Flexion	Extension	Irregular, depending on treatment and on action of nonparalyzed muscles
Upper limbs	Slight and variable	Flexion and adduction	

*See table 3.

A capsular hemiplegia in man may destroy chiefly the motor pyramidal radiations (if at the genu) or chiefly the premotor radiations (if in the anterior limb), but there is much overlapping in the two projection systems as they pass through the capsule, and a vascular accident in this region generally destroys both systems. The symptoms present in a hemiplegia therefore are usually those of a combined motor and premotor lesion with both the pyramidal and nonpyramidal reflexes demonstrable.[11] The size and approximate position of the lesion may be estimated from the reflexes actually present, and from this some indication as to prognosis can be obtained, for if only pyramidal tract signs are exhibited the return of motor power will be more extensive than if the premotor reflexes are present as well; and, conversely, if only premotor reflexes are present without pyramidal tract signs the ultimate prognosis is even better.

THE SYNDROME OF THE MOTOR AREA

It is thus possible readily to differentiate motor from premotor pareses on the basis of the specific reflexes indicated in table 3. The pure motor area syndrome, however, rarely occurs clinically, but it is seen following discrete gunshot wounds, occasionally from small sharply localized tumors, and it has been produced by neurosurgeons[12] in the treatment of athetosis and focal seizures (excision of cortical scars). The characteristics of the syndrome may be summarized as follows:

TABLE 3.—*Reflex Changes Following Unilateral Upper Motor Neuron Lesions (Cortical)*

	Motor (Pyramidal)	Premotor (Nonpyramidal)	Combined Motor and Premotor
Babinski	+	0	++
Chaddock	+	0	+
Spasticity	0	++	+++
Toe fanning	0	+	+
Rossolimo	0	+	++
Mendel-Bechterew	0	+	++
Forced grasping	0	+	+
Hoffmann	0	+	++
Tendon	+*	++	+++
Abdominal	0	?	0
Vasomotor disturbance	0	++	++

*Depressed or absent in early stages following a motor area lesion.

1. Motor Power.—There is gross loss of motor power in specific muscle groups. Thus, if the motor area for the hand has been removed, the digits are completely paralyzed for days or weeks; if the lesion is sharply restricted, motor power in other muscles of the same extremity, for example, biceps or triceps, may be entirely normal. The focal character of motor area paralyses is their most striking characteristic. Foerster and Penfield,[5c] for example, describe paralyses of the interossei of two fingers produced by a tuberculoma the size of a pinhead in the finger representation.

2. Focal Seizures—With expanding lesions of the motor area, focal seizures of the jacksonian type are common. Such seizures begin characteristically with a single muscle group, such as the flexor of the index or hallux, and proceed to involve other muscles of the extremity in definite sequence. The "march" of symptoms in such cases often is exactly the same in all seizures. The motor area seizures thus stand in sharp contrast with the premotor, which begin with a complex pattern of movement generally involving a whole extremity.

3. Reflex Changes.[7a]—These have been enumerated in table 3. They vary to a certain extent with the nature of the lesion. If a given area is surgically excised, all reflexes in the affected muscle are abolished for a variable period. If, on the other hand, the lesion has been made by a gradually expanding tumor, the initial stage of reflex depression may be minimal or entirely absent. The only well recognized pathologic reflexes in the lower extremity associated with interruption of the pyramidal tracts are those of Babinski and Chaddock.

4. Flaccidity.[13]—Resistance to passive manipulation of an extremity whose pyramidal control has been destroyed is generally less than normal and is certainly never increased. This is true despite the fact that some of the deep reflexes, such as the knee and the ankle jerk, may be exaggerated. Knee and ankle clonus are generally not demonstrable, and changes of resting posture with alteration of the position of the body in space do not occur. During the Great War, Head[14] described cases of cortical "hypotonia" following shrapnel injuries of the postcentral convolution. Careful scrutiny of his case histories indicates that in all instances the lesion was adjacent to the central sulcus and therefore undoubtedly involved the motor area within the sulcus. In view of recent experimental studies it seems likely that the "hypotonia" in these cases is due, not to the postcentral involvement, but to the destruction of the motor area itself.

5. Miscellaneous Symptoms.—There is no loss in the patterns of movement in motor area lesions, and if a specific muscle, for example, of the finger, is weak the remaining muscles of the extremity are capable of carrying out any previously acquired skilled movements with accustomed dexterity, which is in sharp contrast with

premotor lesions. Similarly, there is no vasomotor disturbance or other signs of automatic involvement with motor lesions.

THE SYNDROME OF THE PREMOTOR AREA

The differences in the motor and premotor syndromes might be predicted on the basis of their differing response to faradic stimulation. Stimulation of the motor area gives sharply restricted focal responses, whereas stimulation of the premotor region evokes complex patterns of movement. In keeping with this, isolated extirpation of the premotor area, or gradual destruction of it by tumor, gives rise to a series of disturbances that generally appear in clinical cases in the following chronological sequence[15]:

1. Disturbance of Skilled Movements.—Appearing first in clinical cases and persisting longest after experimental lesions, disturbance of skilled movements may be regarded as the primary symptom of a premotor lesion. Long before any impairment of the grip occurs or of gross movements such as those involved in walking and climbing are found, awkwardness may be present and skilled acts such as those previously enumerated are rendered impossible. The deficit is then one involving the coordinated activities of the musculature as a whole.

2. Seizures.—The seizures from premotor lesions begin similarly with a complex movement,[5] generally with turning of the head and eyes to the opposite side ("adversive" seizures), followed by a complex pattern of movement affecting one or both extremities on the opposite side, and often involving to a slight extent the extremities on the same side.

3. Reflex Changes.—After skilled movements have become affected, deep reflexes become markedly increased, and such pathologic signs as those of Rossolimo, Mendel-Bechterew and Hoffmann generally develop (table 3).

4. Spasticity.—With the appearance of the foregoing reflexes, the resistance of the extremity to passive manipulation gradually increases, and strong spasticity may ultimately result.

5. Forced Grasping.[16]—A special manifestation appearing late in the anamnesis of clinical cases and disappearing early following experimental lesions is the prehension phenomenon generally referred to as "forced grasping." It is pathognomonic of a premotor lesion. If forced grasping is poorly developed it can generally be brought out by placing the patient in the lateral position with the affected extremity uppermost, which is the maximal position for the reaction. The Babinski response is generally not present, although lateral deviation of the toes may occur; occasionally exaggerated flexion of the toes is seen in response to plantar stimulation.

6. Vasomotor Disturbances.[9]—The temperature regulation in the affected extremities after a premotor lesion may be disturbed, owing to paralysis of the mechanism for reflex dilatation and reflex sweating.

When lesions occur in the spinal cord or the brain stem, usually both the pyramidal and the nonpyramidal components of the upper motor neuron are affected, and the mixed syndrome is the result. Upper motor neuron lesions of this type are even more complex than those originating in the cortex, since the subcortical motor projection systems are often involved along with cortical systems. But the subcortical extrapyramidal systems are of no concern in this paper, since in mature animals they do not mediate voluntary movements.

SUMMARY

Paralysis of voluntary movement may be due to lesions of either the upper or the lower motor neurons. The manifestations of lower motor neuron lesions are identical with those following section of a motor nerve. Manifestations of upper motor neuron paralysis are various, and in the past no attempt has been made to dissociate the symptoms produced by destruction of the pyramidal pathways from those produced by interruption of other voluntary projection systems from the cortex. Recent studies on the specific components of upper motor neuron lesions in monkeys, apes and man allow the following conclusions:

1. Lesions restricted to the pyramidal tracts or to their cells of origin cause flaccid motor paralysis, muscle atrophy, transient depression of all reflexes, and the positive signs of Babinski anl Chaddock; after complete destruction of the pyramids, the signs of Babinski and Chaddock persist permanently, but the paralysis, flaccidity and reflex changes tend with time to disappear.

2. Lesions of the premotor projection area of the cortex, which also mediate voluntary movements, give rise to spastic paralysis, disturbance of skilled movements, forced grasping, vasomotor disturbances, increased deep reflexes and the signs of Rossolimo, Mendel-Bechterew and Hoffmann. Forced grasping and vasomotor disturbances are transient, but disturbance of skilled movements and the signs of Rossolimo and Hoffmann tend to persist.

3. Hemiplegia in man is generally produced by combined destruction of motor and premotor components of the upper motor neuron, and hence such cases generally exhibit combinations of the foregoing symptoms with more severe ultimate motor paralysis than when only the pyramidal tracts are involved. The prognosis can be inferred from the extent to which the two systems are involved.

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The Physiotherapy Review

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Fourteenth Annual Convention

The fourteenth annual convention of the American Physiotherapy Association is almost at hand. The program committee has been busy, and an interesting program is planned.

Parts of the program are varied somewhat from that of other years. For instance, the address of welcome is to be given at nine o'clock (9 A. M.) Tuesday, June 11th. This is to be followed by the first business session. (Delegates, please take notice.)

Delegates to the convention will do their part, but the support from fellow members is always encouraging. Plan to come to Atlantic City for the convention, and enjoy a week of relaxation at the "World's Play Ground."

No plans have been made for entertainment while in Atlantic City. The proximity of theaters, piers and the beach to convention headquarters makes it unnecessary.

Delegates and members planning to attend the convention are asked, as far as possible, to make their reservations at the Hotel Dennis early. This is important because the American Medical Association convention will meet in Atlantic City at the same time.

Interesting trips are planned for the day following the convention, in Philadelphia, New York and Washington, D. C. Be sure to plan your tickets so you will have the privilege of visiting these places and seeing the clinics as well as the places of historic interest.

Let us make this the largest and most valuable convention the American Physiotherapy Association has ever held. All roads lead to Atlantic City in June. Let's go!

Pennsylvania Chapter.

Program

Tuesday, June 11th

9 A. M.

Address of Welcome, Dr. William Martin, Atlantic City, N. J.

Business Meeting.

12 Noon

Luncheon for discussion of chapter problems. (All members welcome).

4:30 P. M. Tea.

Pennsylvania Chapter hostess.

8 P. M.

"Neurological Diseases Amenable to Physical Therapy," A Review of the Neuro-Anatomy and Pathology. (Lantern Slide Demonstration.) Dr. Nicholas Gotten, M.D., Temple University Hospital.

Methods of Applying Heat Efficiently, Dr. John S. Coulter, Northwestern University.

(Topic to be announced). Dr. Charles L. Lowman, Children's Hospital, Los Angeles.

Wednesday, June 12th

9 A. M.

Panel discussion arranged by Mrs. Caroline Brown. "Physical Therapy in Fractures." The panel will be opened by Dr. M. K. Lindsay of the New Haven Hospital by a talk on "Bone Regeneration." Other members of the panel: Dr. E. L. Compere, University of Chicago; Dr. A. Z. Griswold, Louisville, Kentucky.

2:30 P. M.

Moving Pictures depicting various forms of physical therapy.

"Under Water Physiotherapy."

"Supervised Walking."

Georgia Warm Springs Foundation, Inc., Alice Lou Plastridge, Director of Physiotherapy.

"Post Surgical Use of the Hydrogymnasium."

"Technic of Under Water Gymnastics."

Orthopedic Hospital, Los Angeles; Susan G. Roen, Director of Physiotherapy.

"All Phases of the Treatment of Infantile Paralysis," Harvard Infantile Paralysis Commission.

"Some Mobilizing Exercises for Structural Scoliosis," Janet B. Merrill, Director of Physical Therapeutics.

7:30 P. M.

Formal Dinner.

Toastmaster—Dr. Richard W. Larer.

Thursday, June 13th

9 A. M.

Panel discussion arranged by Miss Constance K. Greene.

"Physiotherapy in Mental Hospitals."

Dr. George S. Amsden, M. D., Psychiatrist-in-Chief, New York Hospital, will give an introductory talk and lead the discussion.

10:30 A. M.

Panel discussion arranged by Miss Josephine Rathbone.

"Problems and Procedures Involved in Trying to Change a Person's Body Mechanics."

Dr. K. G. Hansson, M.D., Ruptured and Crippled Hospital, New York City.

Miss Florence Meyer, Newark Public Schools.

Mr. Norman Fradd, Harvard University.

Miss Lulu Sweigard, New York University.

Miss Emma Schrampf, New York Orthopedic Hospital.

Mr. I. G. Wilson, Wilson-Bowman System of Body Proportioning.

Miss Josephine Petts, Bryn Mawr College.

2 P. M.

Business Meeting.

Friday, June 14th

Pennsylvania, District of Columbia, and New York City Chapters are to be hostesses for the day. Let us remind you again to plan your round trip ticket to include one of these trips.

Catherine Worthingham, Chairman.

Special Clinics at the following hospitals during the Convention:

University Hospital, 34th and Spruce Streets.

Philadelphia General Hospital, 34th and Pine Streets.

Pennsylvania Hospital for Mental Diseases, 44th and Market Streets.

Temple University Hospital, Broad and Ontario Streets.

School of Occupational Therapy, 419 South 19th Street.

Graduate Hospital, 19th and Lombard Streets.

Jefferson Hospital, 10th and Samson Streets.

Refer to the March-April issue of the Review for further data concerning these institutions.

As the Convention draws to a close we decide upon a grand climax, namely, a trip to Philadelphia, a city which has always been recognized as a great Medical Center.

On Friday afternoon, we visit some of the largest hospitals in the city. Special Clinics have been arranged demonstrating the therapeutic values of various types of physical therapy, not overlooking the older and commonly accepted indispensable modes of physical treatment such as baking, massage, hydro-therapy, diathermy, etc.

In the evening we drive out to Robin Hood Dell in Fairmont Park, where we enjoy a concert given by the Philadelphia Orchestra, one of the largest and finest in the country.

Saturday morning we visit other physical therapy clinics in various sections of the city. In the afternoon, as we plan to learn something of the historic background of Philadelphia, we take a sight seing bus, which is conducted from the center of the city. This trip includes many interesting sights such as Betsy Ross House, Independence Hall, and Benjamin Franklin's Tomb.

Pennsylvania Chapter.

Suggested Departments to visit: Washington, D. C.—Children's Hospital, Crippled Children's School, St. Elizabeth's Hospital, Walter Reed Hospital.

Baltimore—Crippled Children's Hospital School.

Remember, there are many points of interest in Washington, D. C., and Baltimore, besides those concerned with physical therapy. The District of Columbia Chapter will suggest some of these in the next Review.

District of Columbia Chapter.

The New York Chapter will be very happy to entertain the members of the American Physiotherapy Association who will come to New York from the Atlantic City convention.

A most interesting program can be arranged at the New York Orthopedic Hospital, and the Columbia and Cornell Medical Centers.

We do not need to mention the many points of interest in our city. Probably most of you will find it necessary to stay up all night in order to go places and see things, if your time is limited.

We hope there will be a goodly gathering in New York on Friday, June 14.

New York Chapter.

Exhibits

It will not be possible to exhibit apparatus of any kind at the Convention this year. However, there will be ample space for any exhibits which can be mounted on a flat surface. Case records, charts, pictures, etc., are suggested. Chapters and individuals please send your material directly to Mr. S. Paul Campbell, Local Convention Chairman, Hotel Dennis, Atlantic City. Mr. Campbell will appreciate having the material as early as possible so that the space can be planned and arranged adequately.

American Medical Association Exhibit

The American Medical Association has granted the American Physiotherapy Association request for a booth

in the Scientific Exhibit this year. The exhibit will be entitled "Modern Technics in the Exercise Treatment of Faulty Body Mechanics." Posters, pictures, case records, etc., will illustrate:

1. Methods of stimulating interest in body mechanics.
2. Principles of progression in exercise treatment.
3. Carry-over of principles learned in exercise treatment.
4. Significant points in kinesiology of water activities.
5. Methods of recording improvement in body mechanics.
6. Case records.

It is with much regret we announce that Dr. J. B. Mennell of London will not be a speaker on the Fracture Panel. In response to our request he cabled that he "would feel highly honored to address us." Meanwhile he has found that he will be unable to leave London in June. In 1930 Dr. Mennell visited us at New Haven. We have been looking forward to another visit ever since that time. To watch him work is a rare treat. One is impressed at once by his extremely fine personality. His patients respond to him immediately. As he administers gentle massage and manipulations he assures his patients they will not be hurt. When one sees him work, one does not wonder he achieves such remarkable results.

Let us hope that Dr. Mennell will be with us in 1936.

World War Convention

The 1935 World War Reconstruction Convention is to be held in Los Angeles, June 26th to 29th. Headquarters at the Hollywood Roosevelt Hotel, Hollywood, California. All World War Reconstruction Aides who are members of the American Physiotherapy Association are heartily invited to attend this convention.

Chapter News Items

Chicago

The Tri-State Assembly of the American Hospital Association is meeting in Chicago at the Hotel Sherman May 1st to 3rd. On Thursday afternoon at 2:30 in the Hotel Sherman, the Chicago and Wisconsin Chapters are holding a sectional meeting. The following program has been arranged:

1. A Self Maintaining Physical Therapy Department. Dr. C. O. Molander, Director of Physical Therapy at Michael Reese. Discussion: Dr. A. C. Bachmeyer, University of Chicago.

2. Educational Standards for Hospital Physical Therapy Technicians. Dr. R. Buerki, Madison, Wisconsin, President elect of the American Hospital Association. Discussion: Dr. W. D. Cutter, Secretary, Council on Medical Education, American Medical Association.

3. Physical Therapy in an Industrial Hospital. Dr. C. H. Ogden, Physical Therapy Department, Illinois Steel, Gary, Indiana. Discussion: Dr. C. H. Ellis, Northwestern University.

4. Administration and Equipment of a Small Physical Therapy Department. Dr. John S. Coulter, Northwestern University. Discussion: Mr. H. A. Carter, Secretary, Council on Physical Therapy, American Medical Association.

Massachusetts

Instead of arranging courses at the members' expense, the Massachusetts Chapter had Dr. William Green of the Children's Hospital give a series of lectures after the regular monthly meetings during February, March and April. These were attended by about fifty members and students.

The topics taken up were: Feb., Pseudo-Hypertrophic Muscular Dystrophy; Mar., Arthritis; Apr., Child Development.

Each lecture was illustrated with moving pictures or slides taken in the research clinics at Children's Hospital.

Several members of our chapter are planning to attend the convention in June.

New York

The New York Chapter gave a bridge party in Greenwich Village, instead of the usual lecture, in January. We were very glad to have with us at this party two of our advisory members, Dr. K. G. Hansson and Dr. Richard Kovacs. The party was considered a success, both socially and financially.

Dr. John De Paul Currence, of the Post Graduate Hospital, was the speaker of the evening at our February meeting. This was held at the Hotel New Yorker in Dr. Currence's private offices. The subject of his talk was "Pathological Conditions in Arthritis," with practical demonstrations in the exceedingly well equipped hydrotherapy department. Although this was a delicate subject for us, it was presented to the perfect satisfaction of our members.

Our March meeting was held at the Polyclinic Hospital. The speakers and their subjects were: Dr. Frank H. Krusen, Director of Physical Medicine, Temple University Hospital, Philadelphia. Dr. K. G. Hansson, Director of Physical Therapy, Ruptured and Crippled Hospital, N. Y. C. Dr. Richard Kovacs, Director of Physical Therapy, Polyclinic Hospital, N. Y. C. Dr. Krusen's subject was "Some Recent Advances in Physical Therapy." Dr. Hansson's subject was "Vital Capacity in Scoliosis." Dr. Kovac's subject was "Low Frequency Currents in Treatment." All of these physicians gave excellent papers.

Texas

The Texas Chapter meeting was held April 18th in Dallas. It was a closed business meeting. During the month of March, Mr. Schwaite of Baylor Hospital, Dallas, talked on "Old and New Uses of Physiotherapy" before the Baylor Hospital auxiliary. Miss Van Tassel gave a demonstration of Fever Therapy at the Methodist Hospital in Dallas, Texas.

Academy of Physical Medicine

Annual Meeting, June 12 and 13, The Claridge Hotel, Atlantic City, New Jersey. For further information, address Arthur H. Ring, M. D., Secretary-Treasurer, Arlington, Mass.

ABSTRACTS

John S. Coulter, M. D.

The Treatment of Fractures About the Ankle Joint
Clay Ray Murray, M.D., in N. E. J. of M., 211:19: Nov. 8, 1934.

Group One

This group consists of those cases in which the functional disturbance is purely that of soft part damage, and is secondary to pain, swelling and inflammatory reaction. It includes fractures of either malleolus, or both, showing neither separation nor displacement of the fragments. Bony union is the rule in all. Rest of the part is best enforced by a posterior molded plaster of Paris splint which need extend only to the knee. Until the soft part pathology is pretty well abolished, a period of two to seven days, I am sure that time is saved by bed rest of the patient. The cold applications for the first twelve to twenty-four hours may be iced cloths or an ice bag, and the heat after the first twenty-four hours is best applied as constant heat of low intensity. A pair of ordinary light bulbs beneath a tent improvised over the feet is extremely satisfactory, and of much more value than the application of intense heat, as from one of the therapeutic lamps, at relatively infrequent intervals. The massage for the first few days can be given with the unbandaged splint in situ; after forty-eight hours it is usually possible to remove the splint for the light stroking massage, and to remove it for active motion within pain limits four to six times daily, the initial periods consisting of a few motions only, gradually increasing as pathology disappears, and with its disappearance pain and stiffness lessen. Frequent short periods of exercise are to be preferred to infrequent and prolonged periods. When the soft part pathology has been adequately reduced, some form of elastic bandage is put on from the base of the toes up to the knee, and the patient is allowed upon crutches. In allowing him up, the foot is not to be dependent more than five minutes out of the hour on the first day, and this time is gradually increased, gauged by the amount of swelling, until there is no limitation. No weight is borne for the first seven to ten days. Then gradually increasing weight bearing is instituted with the crutches. By the end of the second week the crutches are replaced with a cane and the splint is replaced by supportive strapping or by an adequate leather ankle brace, preferably of the type used in skating, with lateral and medial whalebone supports. This latter should be worn steadily for four weeks, and during the next three months it should be worn whenever violent exercise is attempted. Exercises and massage are to be continued to the end of the third week, and during the third week, if swelling on dependency is at all a noticeable factor, alternating hot and cold plunges for the foot and ankle, night and morning, may be very helpful. One minute in hot water and one-half minute in cold water, alternating, over a period of fifteen minutes is adequate. If swelling on dependency remains a notable feature, the use of the elastic bandage or stocking should be prolonged as need be. Where the soft part pathology has been great, and the swelling marked, I have frequently had patients wear this support for six to nine months.

If this regime is followed, the average period of disability, that is, inability to work, should be about three weeks.

Group Two

The functional disturbance in this group is due to malposition of the foot, which is commonly somewhat inverted or everted, dependent upon the mechanism of the injury, and may be displaced slightly outwards as well. The integrity of the mortise of the ankle joint per se is not disturbed. The group embraces all fractures of the external malleolus below or outside the inferior tibio-fibular joint, with displacement of the fragment.

The treatment of this group differs but slightly from that of the preceding one. The first difference lies in the necessity for reduction, that is, the replacement of the foot and malleolus in their normal relationships with the tibia and fibula respectively, and in the necessity of maintaining the normal positions until healing has occurred.

Group Three

This group presents a disturbance of function characterized by inversion or eversion of the foot, dependent upon the mechanism, with almost any possible displacement of the foot on the tibia. It includes fractures of the internal malleolus with separation and dipslacement of the two types and bimalleolar fractures, all without involvement of the inferior tibio-fibular joint. The disturbed function is two-fold, that of malposition of the foot in relation to the tibia, and possible widening of the ankle joint mortise by reason of the malleolar displacements, although the tie bolt of the mortise, the inferior tibio-fibular joint, is intact.

The average time of splinting required in these cases is four weeks. The type of splinting varies in that if the fracture is bimalleolar the splints are best applied extending above the knee for the first ten days to two weeks. Weight-bearing with the protective ankle brace is started at four weeks, and full function at an average of seven weeks. Five weeks may see full function for those who have but little strain to put on foot and ankle, and eight weeks or more may be needed for those whose work entails heavy strain. The elastic bandage is put on beneath the splints at the time of their first removal for massage and exercise.

Group Four

This group comprises the only cases which should be included in the term Pott's fracture. It is a fracture of relatively infrequent occurrence. The difference between it and the other groups described lies in a mortise widened by tearing of the inferior tibio-fibular ligaments, with disruption of that joint and a separation of the tibia and fibula.

Following the reduction the routine is as in the other groups, except that the splints in these cases cannot be removed for a period of four to six weeks without endangering the reduction of the disrupted inferior tibio-fibular joint.

Group Five

This group comprises those cases in which the essential lesion is a comminution and impaction of the

lower tibial articular surface, usually by a fall from a height, the foot driving the astragalus up against the tibia. Fixation is difficult and weight bearing has to be delayed until the healing is strong enough to bear it. This is frequently ten to twelve weeks.

Group Six

In this group I have placed those fractures which are practically never seen alone, but almost invariably as complications of one of the first four groups. The effect of their presence is to complicate the reduction, or to prevent it, and to delay weight bearing in all except the fourth group.

Group Seven

I have included here a series of cases in which the very tip of either malleolus is torn off as part of a sprain. They are called malleolar fractures by many, but are fractures in name only. The lesion is essentially a ligamentous tear, and should be classed as a sprain of the joint and treated as such. When it is the inner malleolus which is involved the lesion requires careful treatment because of the tear and lengthening of the internal lateral ligament.

Sacro-Iliac Conditions

T. E. P. Gocher, M. D., Surgical Adviser, Aetna Life and affiliated Companies, San Francisco, California, in Northwest Medicine XXXIII:11:387, November, 1934.

Frequency

In studying 310 minor back injuries, I found that 57 or 18.4 per cent were sacro-iliac injuries. In a series of 93 cases of sacro-iliac injuries, in 23 cases or 24.7 per cent the joint was affected. In 64 cases or 68.8 per cent the ligaments alone were affected. In six cases the muscle over the joint was affected, that is, 6.5 per cent.

Tests

Patrick's sign is one frequently found. It is performed by placing the foot of the injured joint's side on the opposite knee and pushing down the knee of the injured side. If positive, there will be pain in the sacro-iliac area on the affected side. In 20 tests of this I have found the following ends: (a) Positive in 9 joint lesions or 45 per cent, (b) positive in 11 ligament lesions or 55 per cent.

In tests for sacro-iliac strain I found the following:

Lie on the back on the table; let the leg of the affected side hang over with its own weight. This will cause pain in the sacro-iliac area to become worse if positive.

Bend the body forward to an angle of about 35 to 40 degrees. Give a sharp blow with the flat of the hand on the neck at about the area of the cervical seventh or dorsal first. This, if positive, will get pain in the sacro-iliac joint. You may use the fist and hit the palm of the other hand over this area.

Tests for sacro-iliac relaxation are as follows: Have the leg of the affected side fully extended at the knee. Place one hand over the patella and with the other hand grip the heel. If positive, there usually is a feeling of pain down the back of the thigh. The heel should be lifted. The ham strings are attached to the ischium and any pull tends to displace it on the sacrum. I have found it positive in relaxation of the joint in four cases, synovitis in four cases and arthritis in eight cases.

In sacro-iliac periarthritis the inflammation is chiefly and usually in the anterior surface of the joints. It readily spreads and may affect nerves and even other joints and muscles. The nerve pains are usually of a root nature. The symptoms may become very active and severe and then may subdue and remain quiet for a while and then recur. This condition reacts very little to ordinary treatment. The disability time is very long and may be anywhere from three months to a life time. The only treatment which appears to affect this condition is penetrating diathermy and physical therapy.

The value of the wet pack and the prolonged bath in the treatment of psychotic patients has long been recognized but thus far no precise indications for the employment of these forms of therapy have been determined. It is well known that the effects of the wet pack or the prolonged bath are not always beneficial. In addition to clarifying these problems it is desirable to ascertain if possible the relative effectiveness of packs and baths.

On this account an analysis has been made of the physical and psychological reactions of more than sixty psychotic patients to these therapeutic procedures.

Unless a patient were troubled with a disordered sensorium and therefore likely to be disturbed by illusions and hallucinations, it would seem that packs and baths would be more effective if given in a darkened room. As a rule the results would also be better if the treatments were given in sound proof rooms and if not more than one patient were treated in each room.

The after care of these patients is probably just as important. This means that the release from the pack should be as devoid of external stimuli as possible. After both the pack and the bath the patient should be made comfortable in bed or at least he should not be again exposed to the many sources of stimuli on a disturbed ward. Under ideal conditions these treatments and the after-care would be given in rooms especially constructed for the purpose.

A number of patients have complained of the local painful pressure of restraining sheets used in connection with the packs. More attention should be paid to this disturbing factor so that when additional restraint is necessary or desirable, it might be more evenly distributed.

Adolescent Kyphosis

J. M. Edelstein, Johannesburg, in British J. Surg., XXII:85:119, July, 1934.

Conclusions as to Etiology

If one discards the congenital basis of Schmorl's conception of the etiology of adolescent kyphosis, one is forced to the conclusion that a developmental disturbance arises de novo during the years of puberty. What the nature of that disturbance is, and what its immediate cause, awaits elucidation, but no doubt the question is lined up with the general problem of the etiology of osteochondritis in young subjects. It is possible that a nutritional defect, inimical to normal epiphyseal development, will prove to be the key to the problem of disturbances in the vertebral column as well as to those in other areas of epiphyseal growth. We have in rickets an example of an error of assimilation, or of nutrition, or of both, which affects growing bone so profoundly that distortion comes with ordinary weight-bearing. There are many other biochemical factors besides those of the assimilation of calcium and phosphorus about which, in relation to growing bone, we understand too little.

One cannot but feel that all the etiological possibilities previously discussed are in the final analysis,

at most, of secondary importance only, and that one has to seek for some hitherto undetermined biochemical disturbance to explain why the piphyses of some children fall victims to circumstances which in others have no effect. It is probable that the only significance of the much vaunted factor of "multiple small traumata" is that of a localizing or, at most, an aggravating agency.

In connection with the general subject of epiphyseal growth disturbance in children, another lesion of the spine which occurs in the two to seven year age period may be mentioned. Described by Calve, under the name of "osteochondritis of the vertebral body," it bears certain analogies to the disease which is the subject of this article, and results in an interference with the development of the primary epiphysis for the body centrum. The affection, one example of which has come to my notice, leads to flattening and sclerosis of the affected vertebra and to the development of a kyphos. The analogy between this disease and adolescent kyphosis is emphasized by the fact that in both cases the age of onset is the period of most active growth for the area involved. May there not be also some analogous nutritional factor in both diseases.

Treatment

It is not an easy matter to formulate the treatment of a condition the etiology of which is still so obscure. It is, however, necessary to stress the importance of early recognition of the disease. The onset of even the slightest kyphosis, or of what is popularly known as "round shoulders," in a subject of the age of puberty should demand a radiological examination at the earliest possible moment. Prophylactic measures in the early stages should do much to minimize deformity. It is essential, as was carried out in cases 1 and 2 that in such comparatively early cases complete recumbency should be adopted in order that weight-bearing on the affected column may be reduced to a minimum. In recumbency the ventral parts of the whole column are pulled apart and further compression of the bodies and their epiphyses is lessened. The effect can be heightened if a suitable frame is provided to keep the spine hyperextended. Traction to the legs and head, with elevation of the upper end of the bed, is of great advantage. After a minimum period of three months on the frame, and longer if radiological control demands it, the patient may be let up in a plaster-of-Paris jacket or a leather support. The latter appliance, worn for several years after, is of value in preventing the increase of residual deformity, which unfortunately occurs to some extent, in spite of most careful treatment. Pain is most certainly relieved by the wearing of a posterior support.

It is possible that earlier radiological examination of youths who complain of "backache" may reveal the condition before the appearance of kyphosis. This, of course, is not a simple matter because so many of the cases have few or no symptoms in the early stages.

It is very doubtful whether for those cases with deformity of considerable duration much can be accomplished. Mobilizing measures such as gymnastic exercises, massage, etc., are of negligible value at a stage when fixed rigidity has been present during several years. One's own experience is that orthopedic gymnastics have not the slightest effect on the deformity in the very late cases, and it is of course obvious that in the earlier stages such measures are definitely contraindicated. There are, however, intermediate stages where the deformity has not yet reached its maximum and where measures to prevent the progress of such deformity are called for. Plaster-of-Paris jackets, put on inasmuch hyperextension of the spine as it is possible to obtain, are to be applied and re-applied at intervals, until such time as the deformity shows no tendency to progress. As a precautionary measure a posterior spinal support may be used later.

Treatment on the whole cannot be said to be satisfactory in its results, and that is perhaps to be expected, in view of the present state of our knowledge with regard to the etiology of the lesion which is responsible for the deformity.

Summary

A kyphotic deformity may occur in adolescents resulting from disturbances of vertebral ossification.

The ossification of the column and the deviations from the normal consequent upon the onset of the growth disturbances are described.

The lesion results in wedge-shaped deformation of several vertebral bodies. The kyphosis which this gives rise to, being sometimes unaccompanied by pain, may at first pass unnoticed. Movements of the spine are but little affected, but disfigurement is progressive.

Eight cases are reported illustrating various phases of the disease, and their radiological features are described.

A critical survey of the etiology is presented and the conclusion is drawn that most, if not all, the etiological factors usually cited to explain this and other epiphyseal disturbances of a similar nature are of secondary significance only.

The tentative suggestion is made that some biochemical disturbance, based possibly on an error of nutrition or of assimilation, is at the root of such epiphyseal affections.

The lines of treatment are indicated and special emphasis is laid on the importance of early recognition of the disease.

Common Misconceptions Concerning Massage and Mechano-Therapeutics

E. Cyriax in Brit. J. Phys. Med., 1933, 8:92; abst. in Can. M. A. J., 31:4:449, October, 1934.

Surrounding the treatment of disease by active and passive movements there are many erroneous views. Not only are nomenclatures as used, extremely faulty, but many misconceptions also obtain in relation to the active application of this art. Some of these erroneous views are due to the fact that many who have written on the subject have quite an insufficient knowledge of the subject. A very common misconception is that a period of rest should follow every massage treatment. This is quite without physiological basis, for both clinical and experimental evidence shows nothing whatever in the nature of a strain or severe reaction for which rest is essential in order to ensure recovery.

In prescribing muscle massage, most medical men have in mind stimulating the venous and lymphatic return. While this may be applicable in situations where there is stasis and oedema, it is not true in muscles that are weakened because of disuse or nerve impairment. Because of experimental researches we now definitely know that massage influences muscles by stimulating their nervous elements. Since effleurage, so frequently employed, can produce no stimulating effect, it is little to be wondered at that the treatment of infantile paralysis and other muscle dystrophies is often very slow in showing any improvement. Since many are central in origin re-education is the indication that should chiefly be served.

Some Problems in the Study of Sciatica

J. Barnes Burt, M. D., Section of Physical Medicine, Proc. Roy. Soc. Med., xxviii:1:73, November, 1934.

We must all admit that the literature on sciatica is somewhat varied and contradictory, and the information provided does little to assist the medical man in the management of a case. The members of this Section see more cases than all the other Sections put together, and in view of the vagueness of most textbook descriptions and the uncertainties of treatment, I feel that a discussion may help to put the subject on a more practical basis. With the introduction of modern methods of examination our knowledge of sciatica has improved enormously, and the time has come to use the pruning hook on the mass of dead wood which has inevitably formed around a disease recognized for centuries.

The Varieties of Referred Sciatica

Osteoarthritis of the hip.—This as a cause of referred sciatica is very much exaggerated. The referred pain in this condition is generally along the anterior crural nerve to the knee. When it is along the sciatic nerve the pain is slight, and only mentioned by the patient on being asked a direct question.

Sacroiliac disease.—This is a common cause of referred sciatica, and the diagnosis of the condition is full of problems. In many cases of true sciatica there is pain and tenderness over the sacroiliac joint, the pain being referred along the small branch of the nerve which passes into the joint. There is no actual inflammation of the joint in these cases.

Sciatica due to gluteal or trochanteric bursitis is not common. In these cases there is no pain above the line of the ischial tuberosity, and diagnosis is based on finding the tenderness strictly localized to the bursae.

Fibrositis of the gluteus medius and gluteus minimus.—To me this is the most interesting of the referred sciaticas, partly because it is not mentioned in the textbooks, and partly because it is easily cured if correctly treated. These muscles for the most part lie on bone, and are covered by one of the firmest aponeuroses in the body. A branch of the superior gluteal nerve travels along the surface of the ilium to supply the muscles. Any inflammatory swelling of the muscle in this confined space sets up pressure on the nerve, or possibly the nerve is involved in the inflammation, and the pain is referred to areas of the leg supplied by the fourth and fifth lumbar, chiefly the peroneal branch of the sciatic nerve.

The diagnosis depends on finding definite fibrositis in the gluteal muscle, absence of Lasegue's sign, and absence of tenderness over the trunk of the sciatic nerve. Many cases of sciatica in which there is quick recovery belong to this class.

There are two modifications in Lasegue's sign which may prove extremely useful:

(a) Dr. Mennell's. This sign is useful in separating the two conditions, trunk sciatica and sacroiliac lesions. The modification consists of flexion and extension of the foot whilst raising the leg with the knee straight. With the foot flexed the leg can be raised higher in trunk sciatica than when the foot is extended, whereas the flexion and extension of the foot makes no difference in sacroiliac diseases.

(b) The floor sign. The patient sits on the floor with the back resting against the wall. This fixes the pelvis and reduces the spasm of hamstrings. The sign is positive where the back of the knee cannot be made to touch the floor. Excluding cases of arthritis of the knee, the sign is only present in acute trunk sciatica, or where there are adhesions between the sheath and the nerve.

Every type of sciatica requires physical treatment, and it is well to remember Buckley's aphorism: "A textbook of anatomy is better guide to treatment than a treatise on therapeutics."

There is some uncertainty with regard to the value of manipulation, stretching of the nerve, and the injection of saline and oxygen. I feel that these subjects would be best discussed at a joint meeting of the Section of Orthopedics and this Section.

There is much difference of opinion with regard to the value of massage. Some authorities say that it is always harmful, others, like Pemberton, say that massage is the agent which accomplishes the most. The truth, as usual, lies half way between the two views. Sciatic pain caused by gluteal fibrositis can be cured by early massage to the affected muscles, but this ought to be followed by at least an hour's rest in bed after each application, and the doctor must state definitely in his prescription "gluteal muscles only," otherwise the masseur devotes much of his time to the painful area, which is situated in the leg, and massage to this part is harmful.

Again, massage is of value in the sacroiliac strain. In all other cases of sciatic pain massage is definitely harmful except in the final stages when the disease is no longer active and wasted muscles require treatment.

The Continuous Measurement of the Velocity of Venous Blood Flow in the Arm During Exercise and Change of Posture

S. H. Proger and L. Dexter (From the Boston Dispensary, Boston, Mass.). The Am. J. Physiol., 109:4:688, Oct. 1, 1934.

Knowledge of the changes produced in blood flow through the extremities of man by exercise and changes in posture remains incomplete despite the fact that considerable theoretical as well as practical importance attaches to the subject. The fragmentary and conflicting character of the evidence is due not to a lack of interest on the part of investigators but to the technical difficulties in the continuous measurement of blood flow in man.

Conclusions

The method recently described by Gibbs has been found useful and practicable as a means for measuring continuously the relative velocity of blood flow and in certain instances qualitative changes in volume flow.

In cases in which it is desired to record changes in velocity in a vessel which is visible, a solid needle in which hot and cold thermo-junctions have been incorporated has certain advantages over an open needle into which the thin wires containing the junctions are threaded after venipuncture.

The velocity of blood flow in the superficial and deep veins of the arm behave antagonistically with exercise of that arm, the flow in the deeper veins becoming more rapid and in the superficial veins slower than at rest.

With moderately severe exercise involving chiefly the lower extremities (pedalling on a stationary bicycle), there is no change in the velocity of blood flow in the veins of the upper extremities.

In the superficial and deep veins of the upper extremities, the velocity of blood flow is slower with the arm held in the erect position, and more rapid with the arm hanging down, than when the arm is in the horizontal position.

Book Reviews

PHYSIOLOGY OF MUSCULAR ACTIVITY, by Edward C. Schneider, M.P.E., Ph.d., D.Sc., Professor of Biology at Wesleyan University, Middletown, Connecticut. 12mo of 401 pages with 27 figures. Philadelphia and London. W. B. Saunders Company, 1933. Cloth, $2.75 net.

Of all physical agents exercise is the one most frequently used by the physical therapist. This volume gives a clear discussion of the physiology of muscular activity.

A partial list of the subjects considered shows the importance of this volume to those interested in physical therapy. The theories of muscular contraction and the stiffness and pain of muscular exercise are discussed in the first chapter. There are chapters on the role of oxygen in physical exertion, the blood changes of exercise, and several chapters on the effects of exercise on the frequency of the heart beat, and on the circulation of the blood during exercise. Fatigue and staleness, tests of physical fitness, and effects of frequent and regular exercise are fully considered.

In this volume, it is kept in mind that the activity of every organ is more or less integrative, and that while the number of bodily variables during physical exercise is large, it is shown how these variables are correlated and how they maintain the efficiency and stability of the bodily machine as a whole.

RULES FOR RECOVERY FROM PULMONARY TUBERCULOSIS. By Lawrence Brown, M.D., Saranac Lake, New York. 6th Edition. Cloth. Pp. 275. Price $1.75. Lea & Febiger, Philadelphia, 1934.

This volume should be in the hands of every physical therapist interested in the care of the tuberculous patients. Of special value are the chapters on exercise and heliotherapy. In the chapter on exercise it is emphasized that exercise is as important as rest in the treatment of pulmonary tuberculosis but vastly more dangerous. There is an interesting table of energy expenditure under different conditions of muscular activity.

In the chapter on heliotherapy there is an excellent explanation for patients on the physics, physiologic action and uses of the sun and artificial sources of radiation. The book is recommended for the tuberculous patient and for those caring for them.

MODERN TREATMENT OF FRACTURES, by H. Waldo Spiers, A.B., M.D., Professor of Orthopedic and Fracture Surgery, College of Medical Evangelists, Los Angeles, California. Cloth. Pp. 129. Price $2.00. Baltimore, William Wood & Company, 1935.

This volume is a brief outline of the fundamentals of the modern treatment of fractures. The 109 line drawings illustrate the various types of fractures and the recent methods of treatment. These illustrations and the clear and brief discussions bring out the principles of fracture treatment in such a manner that this book can be recommended to every physical therapist.

LECTURES ON MEDICAL ELECTRICITY. By Elkin P. Cumberbatch, M.A., B.M. (Oxon.) D.M. R.E. (Camb.), F.R.C.P., Medical Officer in Charge, Electrical Department, and Lecturer on Medical Electricity, St. Bartholomew's Hospital, Examiner in Medical Electrology, University of Cambridge. Cloth. Pp. 236, with 38 Illustrations. Price 6/-, London, Henry Kimpton, 1934.

This volume provides an excellent method of instruction in medical electricity. The lecture makes the reading of the book more interesting and profitable to the student than the usual statements of facts.

There are chapters on the galvanic current, and its uses in medical ionization, electro-chemical cauterization, and the electrical stimulation of muscle and nerve. The electrical reaction of muscle and nerve are considered. There are lectures on medical diathermy, the high frequency effluve, surgical diathermy, electrodesiccation, the cutting current, the static current and the infra-red, visible and ultra-violet rays.

In many places the lecture method of writing and lack of space prevents sufficient discussion of the various phases of the subject. The student under medical diathermy is directed to take down the following note: "The most widely employed electrothermic method is one in which an electric current, passing along the tissues, overcomes their resistance and heats them through and through. In other words, it produces diathermy." Certainly our experiments on animals prove that medical diathermy does not heat the tissues through and through as is suggested in this note. The exact path of the current is not known, but the greatest degree of heat is always at or near to the surface in the region of the electrodes.

Generally the statements are conservative and the notes given for the students are excellent summaries of the general discussion. The volume can be recommended for students of medical electricity studying under an instructor.

Mississippi Valley Medical Society

A new medical organization to be known as the MISSISSIPPI VALLEY MEDICAL SOCIETY was formally organized at Quincy, Illinois, on April 8. The sole purpose of the new society is to hold an annual meeting each fall devoted to intensive post-graduate instruction and conducted by the leading clinical teachers of the United States. The programs will be eminently practical and of particular interest to the general practitioner.

The society will especially appeal to the physicians of Illinois, Missouri, and Iowa, and the annual meetings will be held in cities on the Mississippi River in these states. The first meeting will be held in Quincy during the month of October or November and will be a three-day session. The society has already been approved by the Adams County Medical Society of Illinois (Quincy), and the Marion-Ralls County Medical Society of Missouri (Hannibal).

The control of the organization is in the hands of a Board of Directors, consisting of one director to each 1,000 physicians in the states of Illinois, Missouri, and Iowa. The officers elected to serve for 1935 are:

President, Dr. Walter Stevenson, Quincy, Illinois.

President-Elect, Dr. H. B. Goodrich, Hannibal, Missouri.

1st Vice-President, Dr. H. P. Coleman, Canton, Illinois.

2nd Vice-President, Dr. E. A. Cunningham, Louisiana, Missouri.

3rd Vice-President, Dr. Wm. Rankin, Keokuk, Iowa.

Secretary-Treasurer, Dr. Harold Swanberg, Quincy, Illinois.

An Advisory Committee, including the following

prominent physicians, has been elected by the Board of Directors:

Dr. Walter Bierring of Des Moines, President of the A. M. A.

Dr. Allen Pusey of Chicago, Dr. A. D. Bevan of Chicago, Dr. Malcolm Harris of Chicago, Past-Presidents of the A. M. A.

Dr. Charles B. Reed of Chicago, President-Elect of the Illinois State Medical Society.

Dr. E. Lee Miller of Kansas City, President-Elect of the Missouri State Medical Society.

Dr. Thomas A. Burcham of Des Moines, President-Elect of the Iowa State Medical Society.

Membership in the society will be open to all ethical physicians, it being a prerequisite that all members hold membership in their respective state medical societies. In order to get started quickly, the Board of Directors has elected to place the membership fee and dues for the first year at only $3.00 and life membership at $25.00, provided these are paid before the time of the annual meeting. Charter membership will close July 1, 1935. Members will attend the annual meetings without payment of a registration fee.

The Board of Directors is desirous of securing one thousand physicians as charter members in order to provide a caliber of program at the Quincy meeting that has never been equalled in this section of the Mississippi Valley. Ethical physicians interested in the new organization are urged to communicate with Harold Swanberg, M. D., Secretary-Treasurer, 211-224 W. C. U. Bldg., Quincy, Illinois.

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ADMISSION to this course is restricted to women who are graduates of accredited Schools of Physical Education or Nursing. As the students are rated as clinical assistants at the various hospitals, only a limited number can be accepted. **Admission is subject to the approval of the instructor.**

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